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Two Spindle Milling Machine.

We give herewith a general view of a new milling machine, arranged to work a vertical and a horizontal spindle at the same time if desired, or the horizontal spindle may carry a cutter arbor extending across the bed and having an outboard support.

As shown by the engraving, there is, in addition to the usual cross-rail, a sliding head fitted to the face of each upright and, by means of hinged bolts attached to these heads and slotted pockets formed in the lower edge of the cross-rail, the heads can be attached to the latter, and when so attached are in line with each other and with the platen, and, of course, move vertically with the cross-rail. Both these heads are, however, independently counterbalanced, the one carrying the horizontal spindle having an independent means of vertical adjustment by rack and pinion movement.

In addition to the changes of speed provided for by stepped pulleys in the usual way there is, on each spindle, a duplex system of driving consisting of a worm and wheel, and, side by side with it, a helical gear drive. Clutches provide a means of readily changing from one to the other, and thus there are two rates of motion for each speed of the transmitting mechanism. Both the worm and the helical gearing are driven from the single horizontal splined shaft above the cross-rail.

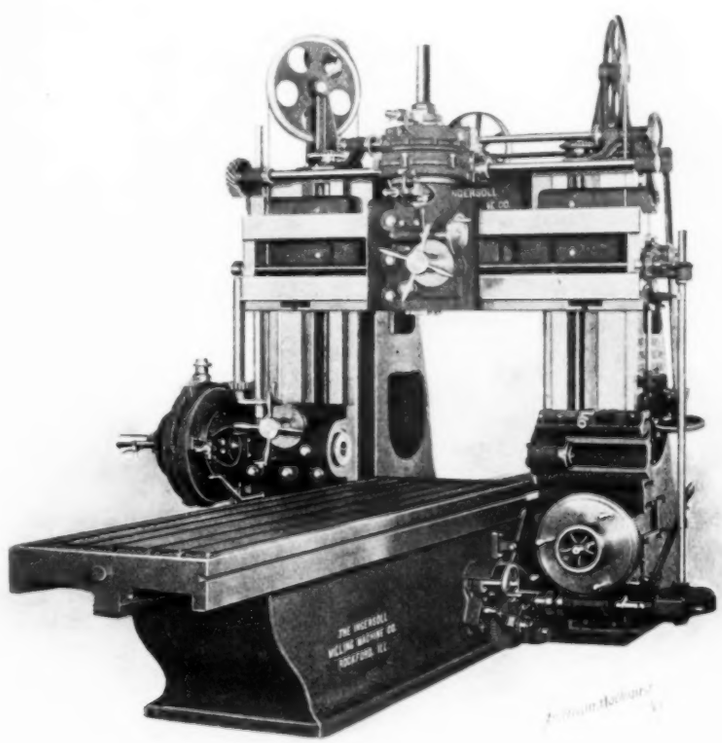
The speeds of the two spindles can be independently varied to suit circumstances, and the range is between speeds suitable for a 2-inch cutter down to those suitable for an 18-inch cutter, and two cutters, differing from each other anywhere between these two extremes, can be used simultaneously.

The vertical adjustment of cutter arbors is graduated to read to .001 inch or to .02 millimeter, as may be desired, and there is also a rapid vertical movement by power. Both spindles have an independent endwise adjustment of 8 inches, and this may be rapid by means of the small spoked wheels, or, for fine adjustment, by means of the worms and gears, as shown.

The platen feed is reversible, ranges from 3-16 of an inch to 10 inches per minute, and the platen can also be traversed by power in either direction 30 feet per minute.

The feed for the vertical spindle (along the cross-rail) is so arranged that it automatically reverses when the platen feed reverses, or reverses independently, as circumstances may require. Its rate of speed also ranges from 3-16 of an inch to 10 inches per minute.

The machine shown will mill work 32 inches wide and 32 inches high under the vertical spindle. The platen is 8 feet long. The machine is built in various other sizes, ranging from 24 by 24 inches to 60 by 36 inches, by the Ingersoll Milling Machine Company, Rockford, Ill.



TWO SPINDLE MILLER.

A Swedish Worm Wheel Cutting Machine and a Swedish Lathe.

BY JOHN E. SWEET.

Those readers of the "American Machinist" who followed my account of our wanderings last summer will, I have no doubt, remember, among other things, the brief description I gave of a machine for cutting worm gears at the Stockholm Exhibition.

I now have the pleasure of sending photographs of this machine, which the makers, the Atlas Company, of Stockholm, have sent me; and I have no doubt they will be found interesting enough to justify reproduction.

I think it hardly necessary to direct attention to the photographs as specimens

of photography, but it may be well to call the attention of those who think the Swedes make only wooden shoes to the ingenuity, design and evident good workmanship of the machine itself.

The description given in the maker's own language is quite clear; the aim of the device being to cut accurate worm gears of any size and pitch without the cost of making tools for every size that may be wanted.

Assuming that a theoretically correct worm gear is possible and a good thing, likely this machine is in every way worthy of consideration.

There are also two or three points in the 16-inch lathe, Fig. 4, of interest. Though perhaps not all original or shown in the "Machinist" for the first time, they are certainly not common and not bad. The maker's description is as follows:

For several years we have used a machine for cutting worm gears designed by Mr. J. A. Nordstedt, who was formerly superintendent of the Atlas shops, and patented by him in the United States of America in 1887.

That machine, as well as the one now exhibited, were founded on the principle described in the "American Machinist," May 27, 1897, and we fully agree with Mr. Gibson's views regarding the merits of worm wheels made in this way.

Wanting a machine for cutting large wheels with coarse pitch we asked the head draftsman of our tool department, Mr. G. Ryd, to design such a machine. The machine exhibited shows that he has perfectly succeeded in constructing a steady and rigid machine, which answers the purpose in every respect. Of course, we use several tools simultaneously, and therefore have cutter heads in which loose teeth are inserted according to the diameter and pitch of the screw.

Fig. 2 shows the same machine used for cutting spur wheels, for which work it has proved satisfactory, and compares favorably with the best American and German machines we use (Gould & Eberhardt and Loewe). As seen from the photograph the milling spindle with its slide rest moves up and down with quick return. The slide is balanced. The indexing is done with a worm wheel of ample diameter fixed on the face plate. It has an arrangement for throwing the screw in or out of gear, by means of which the face plate may be revolved by hand and the screw can be tightened in order to avoid chatter. The reversing and dividing mechanism, with the exception of the gears, are inclosed in the stand, and so constructed that when the machine runs the feed, but not the indexing, may be worked by hand, thereby avoiding the risk of spoiling the wheel.

The feed may be varied between wide limits. For cutting spiral gears and for circular milling we have a special attachment.

At present the machine is used for cutting a worm wheel of 2½ inch pitch with one thread in 10 inches or quadruple threaded.

The corresponding steel screws are of 14 inches diameter and are cut in one of our common lathes of 22 inches swing, which seems a good test of its capacity. To permit the cutting of such screws we have our lathes so arranged that the back gears may be used as change gears, and the lathe is not more strained in cutting a screw of 10-inch pitch with this arrangement than in cutting 1-inch pitch without same.

The bearings of the spindle are cylindrical, with conical adjustable shells.

The taper attachment is independent of the other movements of the slide, and is connected or disconnected by means of a screw. Our 16 inch lathe, Fig. 3, resembles the last mentioned, but has the lead-screw geared with the feed bar so that both the lateral and cross feeds may be operated by the gear wheels and thereby spirals of given pitch may be obtained. The belt cone for the feed is placed on a movable arm, by means of which the belt is tightened and connected with the feed bar by two spur wheels, which may be shifted in order to increase the changes of feed. The handle to throw the back-gear in or out has a stop-pin. No wrench is necessary to loosen the cone, which can be done with one finger. For oiling the spindle or cone there are small valves which open when pressed upon with the end of oil can. The tailstock has such shape that it allows the movement of slide-rests against center of spindle; the lateral feed has automatic stop. We use different tool-posts according to wants of customers.

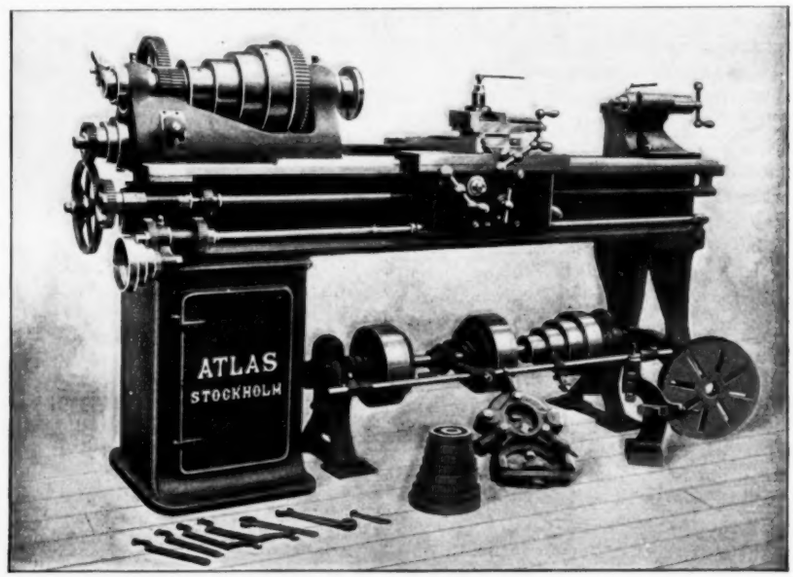


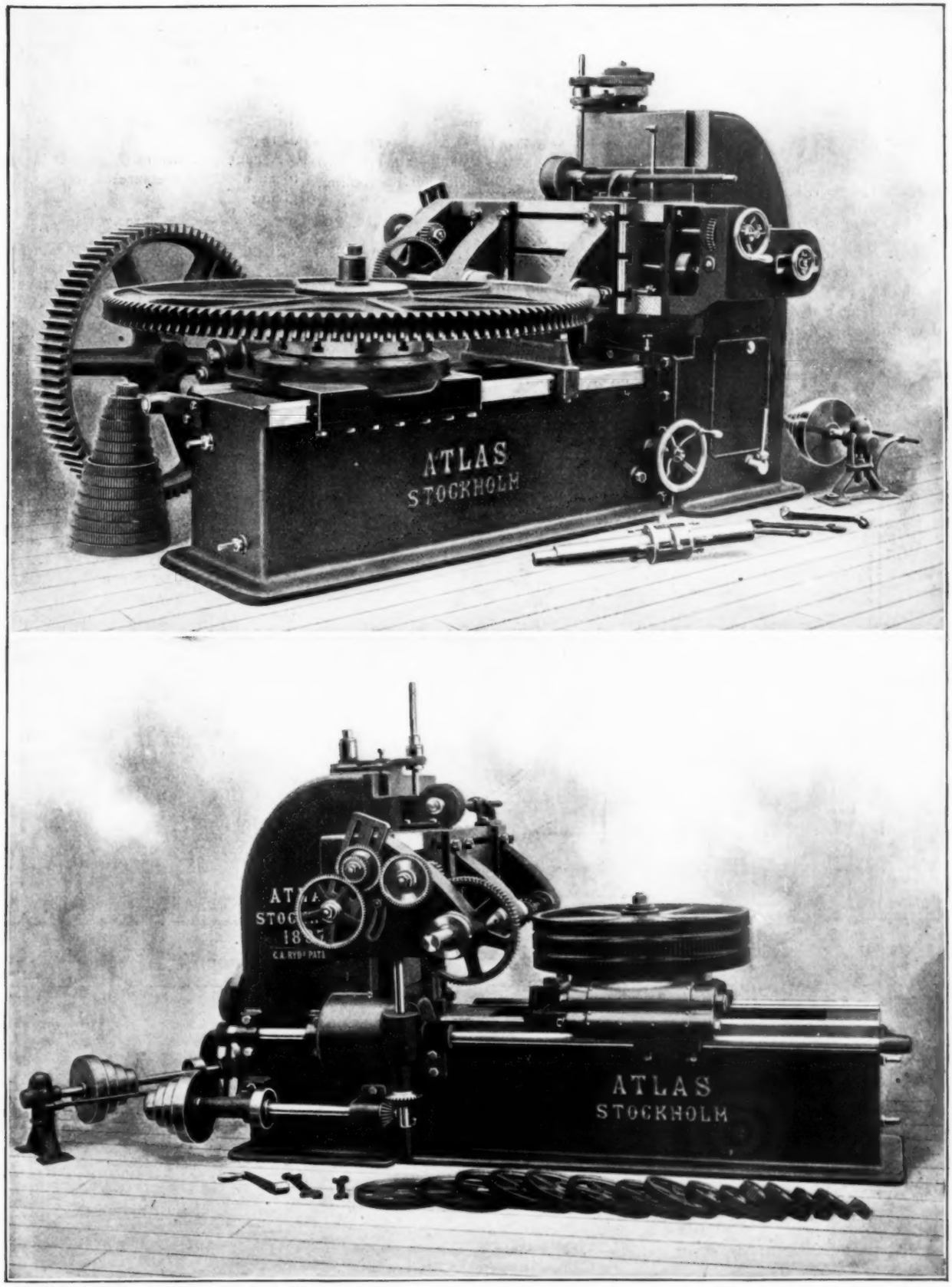
FIG. 3.—16 INCH SWEDISH LATHE.

[This worm wheel cutting machine is of a high degree of interest, and we advise those interested to consult the article published in our issue of June 27 last, where the action will be found described more in detail. It will be seen that the machine is of the generating type, the cutter teeth being fed past the worm wheel blank in short steps, which steps are made at the completion of each revolution of the wheel. The wheel thus goes around continually while the cutter is fed past it through the arc of action of the future worm. The adjustable, multiple, inserted tooth cutter shown on the floor, Fig. 1, obviously adds greatly to the capacity of the machine, and is an additional feature over the machine shown June 27 last.

A worm wheel cutting machine which cuts correct wheels without the use of hobs is of great and obvious utility, and our tool builders are under obligations to Professor Sweet for bringing this machine to their notice. We are not aware of any similar machine in this country, except a small one in the shop of Hugo Bilgram.—ED.]

▲ ▲ ▲

At the New Brunswick, N. J., Iron Works, a few days ago, there was a 6-inch pipe 16 feet long to be bent. They plugged the end, rammed the pipe full of *wet* molding sand, stood it up in the yard and built a fire around it. When the pipe was nearly red hot the plug blew out and the pipe went up and sailed off like a skyrocket. It finally went through a board fence and stopped in an ash heap in a hotel yard. Nobody hurt; something learned, perhaps.



FIGS. 1 AND 2.—WORM CUTTING MACHINE AT WORK ON WORM AND SPUR WHEELS.

The Analysis of Air Compressor Indicator Diagrams—II.

BY F. A. HALSEY.

THE MEAN EFFECTIVE PRESSURE.

The theoretical mean effective pressure for adiabatic compression may be found from the formula:

$$M\,E\,P = 3.45\,P_1\left[\left(\frac{P_2}{P_1}\right)^{.29} - 1\right] \quad (6)$$

in which P_1 is the initial and P_2 the final pressure. If we write:

$\frac{P_2}{P_1} = R$, and rewrite the equation:

$$M\,E\,P = 3.45\,P_1\,[R^{.29} - 1] \quad (7)$$

it is apparent at once that the $M\,E\,P$ is dependent upon P_1 and R only, and if R be kept the same it depends only on P_1 and is proportional to it. If the intercooler reduce the volume of the air received from the low pressure cylinder back to that due to isothermal compression before delivering it to the high pressure cylinder, the ratio of final to initial pressure in the low pressure cylinder will also be the ratio of the cylinder volumes to one another, or it will be the ratio of the lengths of the two combined cards. The work done per stroke is the product of the volume of the cylinder and of the mean effective pressure. That is, calling

W_1 = work per stroke L. P. cylinder
V_1 = volume of " "
P_1 = initial essure " "
R_1 = ratio of initial to final pressure, L. P. cylinder;
W_2 = work per stroke H. P. cylinder
V_2 = volume " "
P_2 = initial pressure " "
R_2 = ratio of initial to final pressure, H. P. cylinder,

we have from (7)

$$W_1 = 3.45\,V_1\,P_1\,[R_1^{.29} - 1] \quad (8)$$
$$W_2 = 3.45\,V_2\,P_2\,[R_2^{.29} - 1] \quad (9)$$

but as shown above, with perfect cooling,

$$\frac{V_2}{V_1} = \frac{P_1}{P_2}$$
$$\text{or } V_1\,P_1 = V_2\,P_2$$

from which it is apparent that if

$$R_1 = R_2$$

then will

$$W_1 = W_2$$

that is, with perfect cooling the work will be equally divided between the cylinders if the ratio of initial to final pressures is the same in both.

The aim with many is to divide the work equally between the cylinders, but for this there is no good reason. The object of compounding is to save power by the intermediate cooling, and that proportion of cylinders is best which gives the largest saving. This will be accomplished when the area between the high pressure compression curve and the adiabatic line of the low pressure cylinder extended is at a maximum, and the cylinders will be best proportioned when this is the case. The point may be thought to be a small one, but attention to it costs nothing, and economies that cost nothing are usually worthy of attention.

The actual finding of the theoretical mean effective pressure requires the finding of the .29th power of R, and, as with the laying out of the theoretical curve, this can only be done by the aid of logarithms, thus given an initial pressure of 14 pounds and a delivery gage pressure of 90 pounds, what is the theoretical $M\,E\,P$, the compressor being at the sea level under a barometric pressure of 14.7 pounds?

A gage pressure of 90 pounds is equal to an absolute pressure of 104.7 pounds, giving

$$R = \frac{104.7}{14} = 7.5$$

(it is almost never necessary to take the value of R beyond the first decimal place). Substituting for R in (7) gives:

$$M\,E\,P = 3.45 \times 14\,[7.5^{.29} - 1]$$

log. 7.5 = .875061
multiply by .29
product .253768
which = log. of $1.7921 = 7.5^{.29}$
$1.7921 - 1 = .7921$
$3.45 \times 14 \times .7921 = 38.27$ pounds per square inch, the $M\,E\,P$ desired.

The chief labor of finding this $M\,E\,P$ is the finding of $R^{.29}$, and this may be greatly abridged by the use of Table I., which gives values for $R^{.29}$ for a range covering ordinary practice. The table also gives directly the $M\,E\,P$ for compression from 14 pounds initial—this figure being used intead of 14.7 for reasons already given.

Affecting the actual $M\,E\,P$ may be mentioned such cooling as there may be from the cylinder jacket and the re-expansion of the air in the clearance spaces, both of which tend to reduce the mean pressure, while the "camel backs" due to the opening of the discharge valves tend to increase it. It is to be understood, of course, that absolute pressures are to be used in all this work.

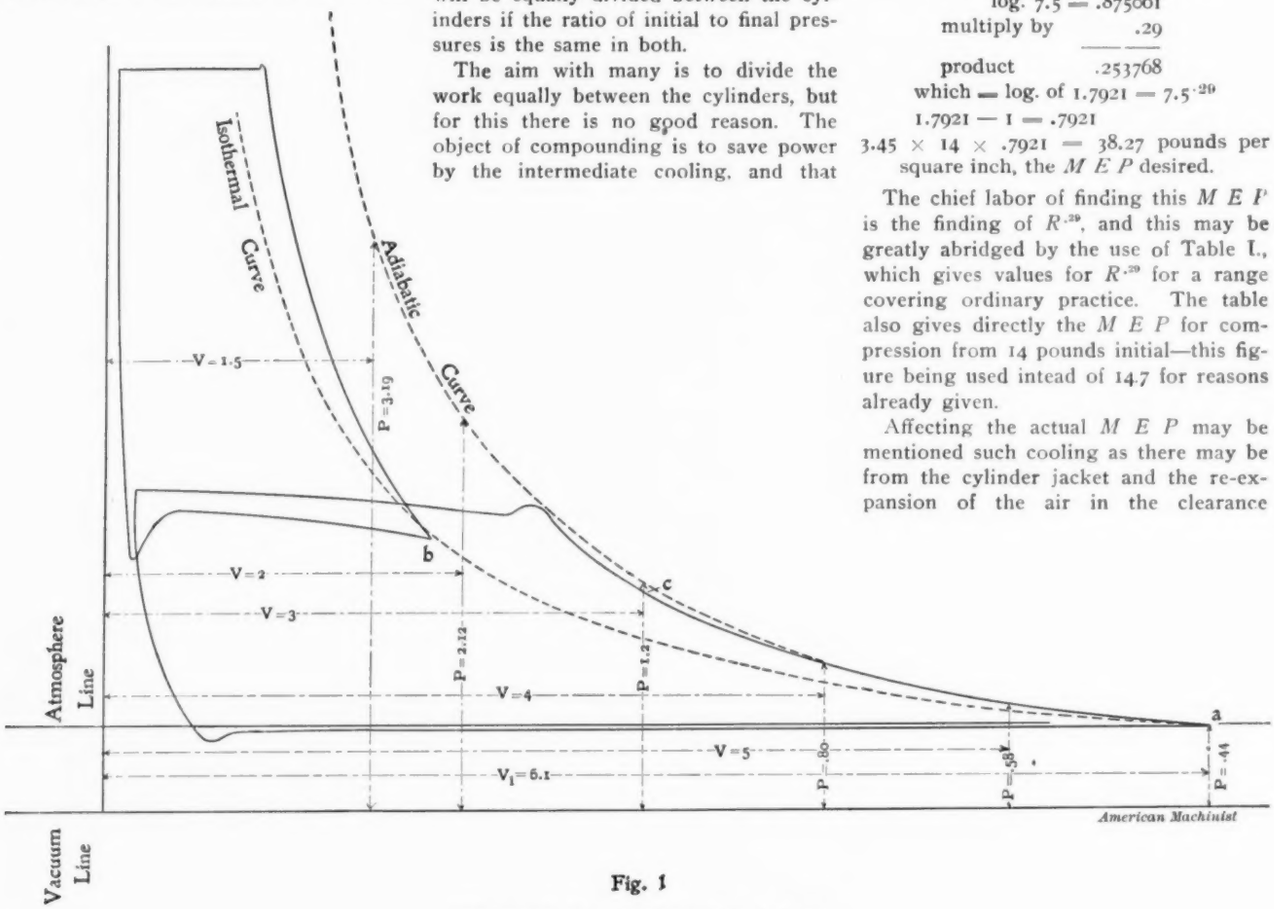


Fig. 1

COMBINED AIR COMPRESSOR CARDS.

THE INDEX OF THE ACTUAL COMPRESSION CURVE.

The finding of the index of the curve traced by the indicator is in a sense the reverse of the preceding. The equation of the curve will in all cases be in the form of (3), except that the index (1.41

Receiver pressure / Initial pressure $= R$	$\left(\frac{\text{Receiver pressure}}{\text{Initial pressure}}\right)^{.29} = R^{.29}$	$M.E.P.$ from 14 pounds initial.	Receiver pressure / Initial pressure $= R$	$\left(\frac{\text{Receiver pressure}}{\text{Initial pressure}}\right)^{.29} = R^{.29}$	$M.E.P.$ from 14 pounds initial.
1.25	1.067	3.24	4.75	1.570	27.5
1.5	1.125	6.04	5.	1.594	28.7
1.75	1.176	8.51	5.25	1.617	29.8
2.	1.223	10.8	5.5	1.639	30.8
2.25	1.265	12.8	5.75	1.660	31.8
2.5	1.304	14.7	6.	1.681	32.8
2.75	1.341	16.4	6.25	1.701	33.8
3.	1.375	18.1	6.5	1.720	34.7
3.25	1.407	19.6	6.75	1.739	35.6
3.5	1.438	21.1	7.	1.757	36.5
3.75	1.467	22.5	7.25	1.775	37.4
4.	1.495	23.9	7.5	1.793	38.3
4.25	1.521	25.2	7.75	1.810	39.1
4.5	1.546	26.4	8.	1.827	39.9

TABLE I.—FOR FINDING MEAN EFFECTIVE PRESSURES OF AIR COMPRESSED ADIABATICALLY.

in (3)) is unknown, and is to be found from the indicator card. To do this the pressure and volume are to be measured at two places on the card*, such as *a* and *c* of Fig. 1 (republished here for convenience of reference). Calling the pressure and volume at *a* P_1 and V_1 and at *c* P and V we would have, if the curve were truly adiabatic,

$$\frac{P}{P_1} = \left(\frac{V_1}{V}\right)^{1.41}$$

as we have already seen. Since the curve is not truly adiabatic the index 1.41 does not hold, and it is desired to find what index may be placed instead of 1.41 and have the equation fit the curve. As the index is unknown, it may be represented by x to indicate that fact, giving the general equation

$$\frac{P}{P_1} = \left(\frac{V_1}{V}\right)^x \qquad (12)$$

which, when x is determined for any given case, will give the required index for that case. The four quantities P_1, V_1, P and V are to be measured from the curve, and the values so found are to be substituted in (12), when the only unknown quantity will be x. Before proceeding to the actual measurements the equation may be put in better shape for solution. To do this in the simplest manner let

$$\frac{P}{P_1} = R$$

and

$$\frac{V_1}{V} = r$$

giving by substitution in (12)

$$R = r^x$$

Now take the logarithm of both sides, giving

$$\log. R = \log. r^x$$
$$\text{or } \log. R = x \log. r$$

from which

$$x = \frac{\log. R}{\log. r} \qquad (13)$$

Measuring the cards gives

$$P = 1.15$$
$$P_1 = .44$$

or

$$\frac{P}{P_1} = R = \frac{1.15}{.44} = 2.61$$

Also

$$V_1 = 6.1$$
$$V = 3.07$$

or

$$\frac{V_1}{V} = r = \frac{6.1}{3.07} = 1.99$$

$$\log. R = \log. 2.61 = .41664$$
$$\text{and } \log. r = \log. 1.99 = .29885$$

giving from (13)

$$x = \frac{\log. R}{\log. r} = \frac{.41664}{.29885} = 1.39$$

This is but little less than 1.41, as was to have been expected from the compression curve following the adiabatic so closely.

This problem does not lend itself to tabulation so neatly as the others, but Table II. avoids the use of logarithms and saves some of the work. Since $x = 1$ represents isothermal compression, while $x = 1.41$ represents adiabatic compression, it is clear that these two values are extremes, and all other values of x must lie between these limits. To use Table II. select such values for P and P_1 that the former shall be an exact multiple—2, 3, 4, 5, 6, 7 or 8 times the latter. Measure V and V_1 to correspond with P and P_1; divide V_1 by V and find the resulting ratio in the column of $\frac{V_1}{V}$ standing under

Higher pressure / Lower pressure $= \frac{P}{P_1} = R = 2$		Higher pressure / Lower pressure $= \frac{P}{P_1} = R = 3$		Higher pressure / Lower pressure $= \frac{P}{P_1} = R = 4$		Higher pressure / Lower pressure $= \frac{P}{P_1} = R = 5$		Higher pressure / Lower pressure $= \frac{P}{P_1} = R = 6$		Higher pressure / Lower pressure $= \frac{P}{P_1} = R = 7$		Higher pressure / Lower pressure $= \frac{P}{P_1} = R = 8$	
Larger volume / Smaller volume $= \frac{V_1}{V} = r =$	Index of curve $= x =$	Larger volume / Smaller volume $= \frac{V_1}{V} = r =$	Index of curve $= x =$	Larger volume / Smaller volume $= \frac{V_1}{V} = r =$	Index of curve $= x =$	Larger volume / Smaller volume $= \frac{V_1}{V} = r =$	Index of curve $= x =$	Larger volume / Smaller volume $= \frac{V_1}{V} = r =$	Index of curve $= x =$	Larger volume / Smaller volume $= \frac{V_1}{V} = r =$	Index of curve $= x =$	Larger volume / Smaller volume $= \frac{V_1}{V} = r =$	Index of curve $= x =$
1.95	1.04	2.95	1.02	3.90	1.02	4.90	1.02	5.80	1.02	6.80	1.02	7.80	1.01
1.90	1.08	2.90	1.03	3.80	1.04	4.80	1.03	5.60	1.04	6.60	1.03	7.60	1.03
1.88	1.10	2.85	1.05	3.70	1.06	4.70	1.04	5.40	1.06	6.40	1.05	7.40	1.04
1.86	1.12	2.80	1.07	3.60	1.08	4.60	1.06	5.20	1.09	6.20	1.07	7.20	1.06
1.84	1.14	2.75	1.09	3.50	1.11	4.50	1.07	5.00	1.12	6.00	1.09	7.00	1.07
1.82	1.16	2.70	1.11	3.40	1.13	4.40	1.09	4.90	1.13	5.80	1.11	6.80	1.09
1.80	1.18	2.65	1.13	3.30	1.16	4.30	1.10	4.80	1.14	5.60	1.13	6.60	1.10
1.78	1.20	2.60	1.15	3.20	1.19	4.20	1.12	4.70	1.16	5.40	1.15	6.40	1.12
1.76	1.23	2.55	1.18	3.10	1.23	4.10	1.14	4.60	1.18	5.20	1.18	6.20	1.14
1.74	1.25	2.50	1.20	3.00	1.26	4.00	1.16	4.50	1.19	5.00	1.21	6.00	1.16
1.72	1.28	2.45	1.23	2.95	1.28	3.90	1.18	4.40	1.21	4.90	1.23	5.80	1.18
1.70	1.31	2.40	1.26	2.90	1.30	3.80	1.21	4.30	1.23	4.80	1.24	5.60	1.21
1.69	1.33	2.35	1.29	2.85	1.33	3.70	1.23	4.20	1.25	4.70	1.26	5.40	1.23
1.68	1.34	2.30	1.32	2.80	1.35	3.60	1.26	4.10	1.27	4.60	1.28	5.20	1.26
1.67	1.36	2.28	1.34	2.78	1.36	3.50	1.29	4.00	1.29	4.50	1.30	5.00	1.29
1.66	1.37	2.26	1.35	2.76	1.37	3.45	1.30	3.90	1.32	4.40	1.32	4.90	1.31
1.65	1.39	2.24	1.36	2.74	1.38	3.40	1.32	3.80	1.34	4.30	1.34	4.80	1.33
1.64	1.41	2.22	1.38	2.72	1.39	3.35	1.33	3.70	1.37	4.20	1.36	4.70	1.35
		2.20	1.40	2.70	1.40	3.30	1.35	3.60	1.40	4.10	1.38	4.60	1.36
						3.25	1.36			4.00	1.40	4.50	1.38
						3.20	1.38					4.40	1.41

TABLE II.—FOR FINDING THE INDEX OF COMPRESSION CURVES.

* To any convenient scale as before. Inches divided into tenths will be found convenient in all cases, and such a scale is here used.

the ratio for $\frac{P}{P_1}$ selected. Opposite the ratio for $\frac{V_1}{V}$ will be found the index required.

These cards are among the best I have ever seen. The action of the intercooler, both as shown by the cards and by the data given at the commencement of this article, will be seen to be well-nigh perfect. The card sent by our correspondent has been engraved full size in Fig. 1 in order that the calculations given may be verified if desired.

▲ ▲ ▲

Rights of Employers and Employes to Inventions of the Latter.

The respective rights of employers and employés to inventions made by the latter during the term of his employment have been much discussed by the courts in the last few years, and the following principles may now be considered settled:

First—In general, the law secures to the inventor, his representatives, or assigns, the exclusive right to the invention, without reference to the condition in life which the inventor occupies. That an invention is made by an employé does not of itself confer any right to or under the invention, or the patent granted therefor, upon the employer, no matter how valuable to the employer's business that invention may be.

Therefore, when an employé, during the term of his employment, but in his own time and at his own expense, invents and reduces the invention to practice, that invention is his own, whether suitable for his employer's business or not, and the patent when granted belongs to him. The employer does not own the invention, nor can he use it without an assignment from or contract with the employé.

But this general principle is much modified by certain special circumstances existing at the time of making and reducing the invention to practice.

Second—Where an employé, of his own suggestion, invents a machine which is useful in his employer's business, and then constructs that machine in the time his employer pays for and with the materials and tools of his employer, then the employé is held to give his employer a license to use that machine, even after the employé leaves that employ; and the employer can keep that machine in repair and continue to use it without liability to pay royalties to the employé.

Third—When the employé, of his own suggestion, invents a process which is useful in his employer's business, and reduces that process to practice in the time his employer pays for and with the employer's tools, materials, etc., and permits the process to be used in the employer's factory, then the employé is held to give an irrevocable license to his employer to use the process in his business; and although the patent, if granted, belongs to the employé, he cannot compel the employer to pay royalties for use of the process.

At present, also, the law appears to be that if the employer was a partnership at the time the invention was reduced to practice and the license arose, under cases second and third, but was afterward converted into a corporation, so that the corporation is rather the successor to the partnership than a different concern, the license continues over to the corporation.

The license, however, in these cases while irrevocable is not exclusive, and the inventor, his representatives, or assigns, can use the invention, dispose of the patent, subject to the employer's license, and can license others to use the invention.

Fourth—Where the employé, of his own suggestion, invents an improved article of the kind in which his employer deals and reduces the invention to practice in the time his employer pays for, and with the employer's tools, materials, etc., and permits his employer to make and sell such articles, then the employé is held to give his employer an irrevocable license to continue to make and sell such articles, and although the patent, if granted, belongs to the employé, he cannot compel the employer to pay royalties therefor.

But this license, also, while irrevocable, is not exclusive, and the employé, his representatives, or assigns can make and sell such articles, dispose of the patent subject to the employer's license, and can license others to make and sell the articles.

The remark made in connection with the preceding cases as to the license passing to a corporation, successor to a partnership, applies also to this case.

Fifth—Where the employer suggests to the employé to make an improvement in an article dealt in by the employer, and thereupon the employé invents the improvement and reduces it to practice in the time the employer pays for, and with the employer's tools, materials, etc., and the improved article is placed on sale by the employer, then the invention belongs to the employer. If the employé obtains a patent for the improvement a Court of Equity will compel him to assign the patent to his employer.

But the courts exercise a jealous care over the right of everyone to the inventions made by him; and, in order to make good the employer's title to the employé's inventions under case fifth, it will be necessary for the employer to prove the facts clearly, and particularly that the original suggestion came from the employer, and that the improvement was made and reduced to practice in the course of the regular employment of the employé.

If negotiations were begun between the employer and the employé during the development of the invention, looking to some special compensation to the employé for the invention, then even if such negotiations fell through, they would strongly tend to defeat the employer's claim to ownership of the invention, as showing the belief of both parties that the invention belonged to the employé, and an intention to compensate him for transferring it to the employer.

D. WALTER BROWN.

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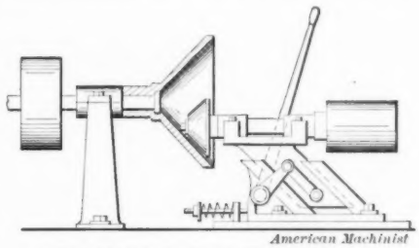
A New Variable Speed Device.

The cut shows a recently patented variable speed device. It is not the positive variable driver that mechanics are still all so anxiously looking for, but as a friction driver has some valuable features. The large internal cone is the driver, and the driven speed is varied by sliding the small cone in or out by the arrangement shown. The friction pressure is regulated by the spring at the left of the horizontal slide. When the small cone reaches the bottom of the large



NEW VARIABLE SPEED DEVICE.

cone and touches all around the drive becomes positive. When the small cone is at the outer edge of the large cone its speed is more than doubled. Probably the most valuable feature of this arrangement is the small amount of necessary sliding that occurs between the friction surfaces, that portion of each which has the greatest surface speed coming together, and *vice versa*. The small pulley at the right must be long enough to make up for the longitudinal movement of the spindle. If the belt leads off at right angles to the plane of movement of the slide, and if it is long enough, its tension should not be much affected.

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What is believed to be the oldest piece of wrought iron in the world is a roughly fashioned sickle blade found by Belzoni in Karnak, near Thebes, and now in the British Museum. Having been found imbedded in mortar under the base of the Sphinx, it is known as "the sickle of the Sphinx." It is believed to be 4,000 years old. The preservative properties of mortar surrounding iron are being constantly realized by those who are pulling down old buildings in this city and elsewhere.

Taper-Pin Turning Tool.

BY A. H. CLEAVES.

The accompanying illustrations will give an idea of a tool, long in use in the watch business, for making regulator pins. These are little brass pins found in the regulator, and placed one on the inside and one on the outside of the outer coil of the hair-spring. They are about 3-16 inch long, and have a slight taper with a diameter at large end 1-32 inch or under.

This tool is superseded now by an entirely different one, and the method of its operation can be suggested by a pencil sharpening device now on the market, and called the planetary sharpener, in which two face mills nicely ground are revolved by a larger wheel acting upon two pinions carrying the two cutters, which face each other at angles suitable to the pencil point. The system revolves around the pencil, which is stationary, and at the same time the two cutters revolve to do the cutting, the pencil standing in a chuck.

In making the pins, I am told, a great length of wire steered through a tube to the machine is fed, turned and cut off automatically to the number of sixty or seventy thousand pins per day.

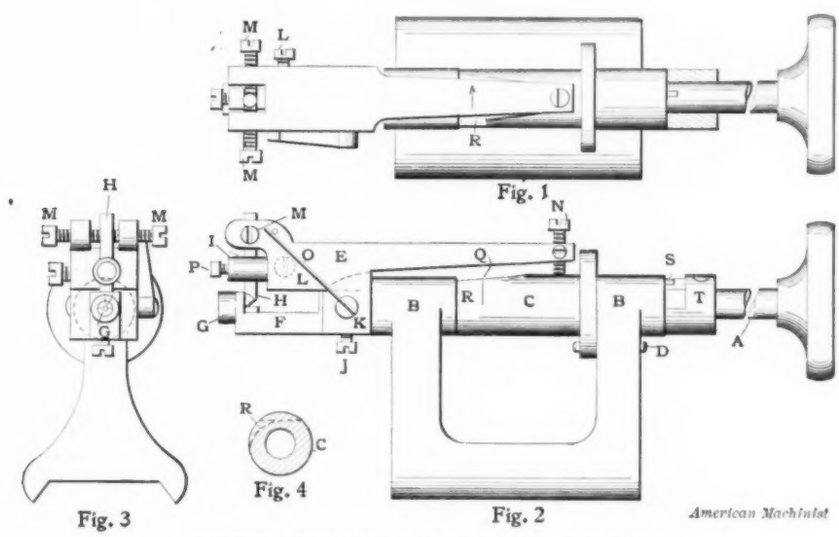
But the tool shown in Figs. 1, 2 and 3 in plan, front and end elevation has no need to be ashamed of its record. It also admits of an easy adaptation for shoulder turning and a variety of profile work.

Taking Fig. 2 as the best explanatory view we have the spindle *A* passing through the bearings *B B* of a lathe footstock, and also through the sleeve *C* between the two bearings. *C* is kept from revolving by the pin *D* in sleeve and footstock.

The part marked *F* is the front end of the spindle *A* and is milled into the shape seen in the different views. It contains in the end a bushing *G* made of sapphire jewel or hardened steel. This is cut down half way, as seen under the tool *H*, where it acts as a rest like the same feature in a box tool for a turret lathe. This, with the complete hole in *G*, guides and supports the stock or wire of which the pins are made.

The turning tool *H* is held in the post *I*, which swivels in the rocking bar *E*, and when adjusted is held in place by the set-screw *L* and the two adjusting screws *M M*. The latter are seen to best advantage at Fig. 3. They rock the tool *H* until the cutting point comes over the center of the wire in *G*. The three screws then being tightened make the tool *H* quite rigid.

The rocking tool-bar *E* makes a joint with *A* by being milled to straddle the same at *K*, and the up and down adjustment of the tool *H* is obtained at the end of this bar with the screw *N* accompanied with a small set-screw, as shown.



FIXTURE FOR TURNING SMALL TAPER PINS.

The brass wire of which the pins are made is fed automatically, as in a screw lathe, while running, and stopped by any convenient gage. Then the spindle *A* is pushed up to the work, the tool *H* engaging with the latter as the point of the screw *N* is going down the incline *Q* on the sleeve *C*. As this end goes down the point of *H* goes up in teeter-board fashion, the rise being regulated by the incline *Q*, which gives the taper *a la* profile style.

When the point of *H* has run out from the cut made at the start or small end of the taper to the large end or outside of wire, the spindle *A* is given a partial turn in the direction of the arrow at *R*, Fig. 1. This turn is regulated by the collar *T*, which has a cut in it, one side of which stops against the pin *S*. This collar also gives the length of the taper pin. When the collar *T* comes up to the foot-stock *B* the partial turn is made on the spindle *A*, and the tool *H* becomes a cutting-off tool, for, as the screw *N* rides up onto the curve *R*, Figs. 1, 2, 4, the point of *H* cuts the wire off directly. The spindle *A* being turned around to opposite stop on *T*, is drawn back to place of starting again.

The use of this device for small shoulder studs or rivets requires no explanation, as it is only a matter of shaping the sleeve *C* and tool *H* as needed.

The stud at *K* carries the flat spring *O*, which in contact with the pin seen in *E* holds the point of screw *N* to *C*. The screw *J* tightens this stud when the right tension is found for the spring; the same stud also acts as the joint pin for *F* and *K*, being tight in *F* and free in *K*.

Chicago, Ill.

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Machine Grinding.

BY C. H. NORTON.

It is sometimes said that all classes of machine tools should be so designed, if possible, as to need little or no care from the operator.

It would seem easy to so arrange a lathe for turning car axles; but when we consider a lathe for watch pivots, we realize that the operator must give it intelligent care or it will fail to produce the work for which it was intended.

There is a point in the scale of refinement where the machine cannot take care of itself, but where the operator must put in a certain part of the refinement he desires to take out.

In our watch and clock works this fact is understood; but there seems to be a growing tendency in our machine building works to depend wholly upon the machine, and little, if any, upon the operator. All are striving to so construct their tools as to meet this demand, and great things are being accomplished along this line. Good grinding machines are no exception, and are well looked after in this particular; yet, if a quarter of a thousandth is removed from the diameter of work by them accurately, they cannot be handled as one would an axle lathe.

The mechanism for moving the cross-feed to accurately remove one-quarter of one-thousandth cannot be anything but a refinement, and must of necessity be handled in a refined way; yet that does not necessarily mean increased cost—in fact, real refinement (not fussiness) in the operation of a grinding machine always reduces the cost. There are probably few grinding machines that are producing what they could in quality or quantity if they were handled with more common sense as to this matter of cleanliness and care of the parts.

Many who are familiar with refinements in other lines of work do not

seem to understand the exceedingly small change in the relation of the axis of wheel and centers of the machine that is sufficient to spoil the work, or what it means to adjust the wheel to such small fractions of an inch as is necessary to grind accurate work, or how important it is to maintain a constant relation of the parts within the narrow limits necessary.

A change of one-twentieth of one-thousandth is fatal in many cases, and a change of one-half of one-thousandth in nearly all. When work is reduced in diameter one-quarter of one-thousandth, the cross slide must move as little as one-eighth of one-thousandth. Let us try and realize how small an amount this is.

If we could split a piece of tissue paper into twelve thicknesses, one of them would represent the motion of the slide when grinding off one-quarter of one-thousandth. Let us try and see the motion necessary to reduce the work one-tenth of one-thousandth. We must now split the paper into thirty thicknesses. These amounts are common in use, and the wonder is that it is even possible when we consider the carelessness with which the machines are often used.

To move accurately to such measurements the cross slide must of necessity be clean, well oiled, and there must be no binding. However nicely the slide is constructed, unless it is moved its entire length and well oiled at least once a day, it is not reasonable to suppose that it will move with the accuracy required; in fact, every moving connection of the slide should have care that it may render such delicate service; yet it is probably true that few grinding machines have their cross slides moved over their entire length and well oiled once in a month, and some are not so treated within a much longer period.

I have seen a machine in which there was no proof that the slide had ever been oiled since it left the maker. This slide worked badly, but was restored to usefulness by cleaning and oiling. While it is true that grinding machines are very useful and produce much good work even when neglected, yet it is also true that they will repay kind treatment liberally in amount and quality of work. It is probable that there are not many in use to-day but what would turn out nearly, if not fully, twice the work they are now doing if they were better treated.

There is a point in connection with the accurate reduction of work which it may be well to speak of here; that is, the selection and use of wheels. I have spoken of this before, but would emphasize it now that a wheel suitable for one job may not be suitable for another. You may grind a large number of pieces at the rate of 100 per day with one wheel, and do the work accurately and well, while with another of just the right grade you may produce 200 equally accurate.

In order that the wheel may remove the exact amount from the work that the dial shows it must cut without pressure, for with pressure the oil in the various connections will yield, the work may spring and the wheel "ride," so that the greater the pressure required to cut the work the more the dial must move to cut off a given amount. Thus it is that a wheel will continue to cut a number of times over after feeding it has ceased.

An unsuitable wheel will many times glaze over and continue so until some jar comes to break the surface. This will bring sharper particles into use and the wheel will cut deeper. This will occur at any time when the dull particles are broken from any cause. The wheel should be so graded and used that its cut will be uniform and require as little pressure as possible.

In one case where I was shown a machine that was supposed to be defective because a uniform cut could not be maintained, the workman had left only a little over one-thousandth of an inch to be ground off from a lot of spindles, so that the wheel at no time could cut over one-half-thousandth deep; and as he did not attempt to remove this all in one cut, the wheel probably never had over one-tenth of a thousandth to cut. This obliged it to cut as a polishing wheel only, and being a hard compressed wheel it glazed over. The operator knowing he had so little to remove, brought the slide forward very cautiously. Through fear of spoiling the work he probably did not turn the wheel to index over one-tenth of a thousandth at a time, as he watched for the effect upon the cut.

This did not give the already smooth wheel enough to get hold of, and he was storing up pressure; then, not seeing it cut, he moved it still more until he got the cut he wanted. This continued a short time, when either friction, a jar or a soft place in the work caused the glaze to give way and be replaced by sharp particles of emery; then, as the wheel was under pressure, it at once "grabbed hold" and spoiled the piece. The trouble was remedied, first, by selecting a more suitable wheel, then leaving from six to eight thousandths to grind off, and at once taking a cut of one or two thousandths from the diameter, and keeping a deep cut until the size was nearly right; then allowing it to pass over under lighter cuts, smoothing off the wheel until the desired surface was obtained. That is to say, the heavy cut freed the wheel at once, allowing it to cut with little pressure, the light cuts producing the finish without movement of the slide; therefore, when the wheel was smooth enough to finish the work, but not glazed, it was cutting without pressure. A suitable wheel will cut smooth without glazing, but cannot be expected to continue so indefinitely without cleaning, either with the diamond or by cutting sufficiently deep on each piece before smoothing down for the finish. The latter method is preferable. The operator in this case had turned these spindles small, supposing that the less he left to grind off the quicker he could grind them; but it was demonstrated that six-thousandths could be ground from them in much shorter time than he was forced to consume in getting the results when only one-thousandth was allowed and an unsuitable wheel was used.

It pays to be particular in selecting a wheel for any case.

From what I have seen I am led to believe that in most shops the operator is obliged to use unsuitable wheels. Sometimes because the executive does not understand the facts, and sometimes because the operator does not understand the matter well enough to inspire confidence sufficient to warrant the purchase of a variety of wheels. This has been brought about in some cases, no doubt, by a workman who would maintain an air of mystery around the machine in order to keep up an excuse for not learning to produce more with it.

They would gain more by becoming students in this line and striving to bring out the great possibilities that are in the grinding machine.

A modern free cutting wheel is an extremely delicate indicator of error. It is easy to misjudge as to the size of the error shown by the cut unless one has given the matter some attention. A writer in these columns has told us of a grinding machine that would change its cut with the movement of the floor caused by his standing either in front or behind it, and seems to think that this fact shows great weakness. No doubt it would appear so to many until they realize the fact that a good wheel will show by its sparks a change in position as related to the surface of the work of .000005 of an inch, or one-half of one-hundredth part of one-thousandth of an inch.

There is in every-day use a steel scale graduated with lines one-tenth of one-thousandth wide. These lines are invisible to the naked eye, yet they are twenty times wider than the change that will cause a free cutting wheel to show sparks. A machine that is bolted to an ordinary shop floor in the ordinary way must indeed be rigid to stand the test of such an indicator as that.

It is evident, I think, that if the machine rests upon three points only, there could be no change of cut caused by such a change of floor, so it would seem useless to consider such a case.

A machine weighing about one ton was resting upon a modern shop floor made up of steel I beams and brick arches, probably a better floor than the average; but it was found that walking

from one side to the other would change the position of the bubble in the level.

Machine tools are being moved to and fro, and their parts are constantly changing their relation to each other; yet we do not know it because there is nothing to make the change visible, but a change of .000005 of an inch in the grinding machine is heralded by fire.

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It is not so long ago that we gave a description of the first fog signal plant driven by an oil engine for a United States lightship. Since that about fifty of these engines, the Hornsby-Akroyd, built by the De La Vergne Refrigerating Machine Company, of this city, have been purchased or ordered by the United States Government, some for lightship and other fog signals and some for lighting forts. The company are now delivering an order of twenty-six of the engines. The torch of the Statue of Liberty, in this harbor, is now lighted by one of these installations. When it was first ordered one of the "new" or "yellow" journals of the day tried to say some unpleasant things against the Government for buying a foreign made plant, when in fact it was built in our own city.

Some Russian Machinery Stores.—A Sight of the Czar.—A Gun of Large Caliber.

A Russian sign painter must be something of an artist. Every business street in a Russian city is lined with oil paintings on wood, and the street is thus made a panorama, representing with varying degrees of fidelity and artistic success whatever is to be found inside the various stores. A butcher's shop, for instance, will be covered outside, in every space not required for windows, with paintings of roasts of beef, hams, sausages, etc. Paintings of violins, drums, cornets, pianos and flutes convey to the Russian mind the same impression that a sign reading "Musical Instruments" would to us. Their show windows are usually much smaller than ours, and they cannot therefore so well display in them the goods that are for sale, and this fact, together with the further fact that the proportion of illiterates is relatively very large among the Russian population, has, I am informed, led to this custom of showing to the passer-by what is to be had within by means of paintings, most of which are quite graphic, and some of them rather startling.

It is not likely that much machinery is sold to Russians who cannot read, but the general custom of pictorial sign painting is carried into the machine business, as is shown by views here given of the places of business of the two leading machinery dealers in the curious and intensely interesting city of Moscow.

Neither of these machinery stores is, however, owned or managed by Russians, though in both cases the men who own them have lived in Russia for many years.

The first place shown is that of Thomas Smith, whose name, as I have written it, will be found at either end of the sign above his store front, while in the center is the same name done into Russian, below this being a legend which I suppose indicates something pertaining to his business.

Mr. Smith is an American, and is the American Vice-Consul at Moscow. His father, who was a Paterson, N. J., man, went to Russia many years ago, when that country was commencing to construct its system of Government railroads, which are modeled after our practice in railroading rather than on the general European practice. The elder Smith took a prominent part in railroad construction and equipment there. Whether his sons were born in Russia or not I

MACHINERY STORE OF THOMAS SMITH, MOSCOW, RUSSIA.

do not know; but whether born there or here they were raised in Russia, and are thoroughly familiar with its language and customs, while at the same time their knowledge of America and of the English language enables them to render valuable service in the work of introducing American machinery and methods into Russia. One of the brothers is in St. Petersburg, where he is at the head of the Russian Worthington Company, while another one is at Sormovo, where his knowledge of the language and customs of the country enables him to render very valuable, if not indispensable, assistance to Mr. W. F. Dixon in his work of carrying on there the manufacture of locomotives with American tools and by American methods, with Russian workmen.

For obvious reasons it was but natural that Mr. Thomas Smith should especially develop a trade with the railroads of Russia, and I understand that the bulk of his business is in that line, though it is extending into other lines gradually. Until recently he has sold only English tools, but is now selling a good many American ones, with, he says, entirely satisfactory results, both for himself and for his customers.

The second illustration is of the store of G. Koeppen & Co. The street at the left of the view is the principal machinery street of the city, and probably the most important one in Russia for the machinery business. A goodly portion of it is lined with pictures of all kinds of machinery, mostly of English and German origin, the paintings having been executed before our American machinery had begun to get much of a foothold. Before going to Russia I had heard of this street (the name of which has been translated into English for me as Miasnitzkaia) as the most important street in the world for machinery business. This is by no means the case, however, and I believe that Liberty street, in New York, does more machinery business in any normal day than is done here in a month. When you get behind the signs you usually find that the people doing business there do not carry stocks of the machinery represented on them, but that they will take your order for what you require and procure it for you from the builder. In the places here illustrated, however, stocks are carried, that to be found in the store of Koeppen & Co. being especially full, and very fairly representative of American machine tool builders.

The flags seen in the second illustration formed a portion of the general decoration of the city in honor of the visit of the King of Siam, who visited Moscow about the time I was there. On the previous Saturday afternoon, at Peterhof, where is the summer residence of the Czar, and which is a pleasant hour's sail by steamer from St. Petersburg through the Bay of Cronstadt, I had witnessed the arrival of this potentate by rail, and had seen the Czar in his carriage on the way to the station to meet and welcome his royal guest and again on the way back in the same carriage, the two side by side, and the carriage always moving at the utmost speed of two thoroughbreds. A Russian and an American friend and myself, after spending the early part of the afternoon in wandering about the palace grounds, viewing the various buildings and the famous gardens, with their fountains, which are surpassed, if at all, only by those at Versailles, drove to a point opposite the gate from which the Czar was to emerge from the palace grounds on his way to the railroad station. The gate stood open, and, after seeing his brother and various other members of the royal family pass out at intervals, at last there came the Czar, his carriage moving at a furious pace and followed closely by two mounted Cossacks, with their carbines held in position for instant firing. At the gate they wheeled and turned back, while the carriage, turning in front of us, proceeded between lines of Cossacks on foot and stationed on both sides of the road. Returning, the carriage was preceded and followed by companies of mounted Cossacks in bright red uniforms and with their horses going at a furious gallop to keep the pace with the fast trotters drawing the royal carriage. The butt of every Cossack's carbine rested on his hip, every trigger had a finger upon it, and it was evident that the least suscious movement upon the part of the crowd that thinly lined the road would have been met by an instant volley.

What I do not understand is why the point at which we stood was not better guarded. We were across the road, exactly in front of the gate from which the Czar emerged. No Cossacks were there and apparently no special precautions were taken at that point. Perhaps it was better guarded than I thought, however, for during the wait between the two appearances of the Czar at that point I, in the course of conversation, suddenly broke in with a question addressed to my Russian friend, and said: "Does the Czar ever——" I was checked by an admonitory gesture, and very earnestly requested not to mention the Czar nor refer to him in any way. Afterward it was explained to me that we, strangers and evidently foreigners, were, as a matter of course, under close surveillance all the time we were in that place. That it was probable that more than half of the people surrounding us were detectives and members of the secret police, and that it would be decidedly better for us not to evince any curiosity to know anything of the habits of the Czar or to mention his name or title in any way. I had intended to ask if the Czar were in the habit of making public addresses. My query regarding that point remains unanswered, and I am wondering if I send to the Czar a marked copy of this number of the "American Machinist" if he would tell me about that; and also if he does not make public speeches to his subjects, which I suspect is the case, then why he does not. I expect the fact is that if he wanted to make speeches in public the chief of police wouldn't let him; for they say that the chief of police bosses the Czar, and tells him what he may do and what he may not do, the Czar understanding, of course, that not the chief of police would inflict the penalty of disobedience, but others who ever seek the opportunity.

Of course, everyone who goes to Moscow visits the Kremlin and sees there, along with a lot of other very interesting things, the great bell which is the largest in the world, but was ruined by fire before being hung. I saw it, but was more impressed by the great gun which is within the same inclosing walls, and which, like the bell, is the largest of its kind. A reproduction of a photograph of this gun is given herewith, and the fact that several Russians are photographed with it enables one to form a pretty accurate idea of its magnitude. The gun is a bronze casting, and the carriage is of the same material, as also are the projectiles, four of which are seen on the ground in front of the gun. Though much larger in caliber than any guns which are made in these days, it would scarcely be considered a formidable weapon in modern warfare, and its present use is only as a curious and rather interesting monument.

It is known as the Tsar-Pushka (Tsar-Cannon), and was cast in 1586, during the reign of Theodore I., whose effigy is upon it. By a special ukase of Peter the Great it was exempted from an order under which a large number of other interesting guns were melted up and recast. Its weight is nearly 40 tons and its caliber about 30 inches. F. J. M.

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At the Germantown Knitting Mills, Germantown, Pa., a few mornings ago, a cylinder head was blown off, driven through a brick wall, across a driveway and through the window of an ice factory.

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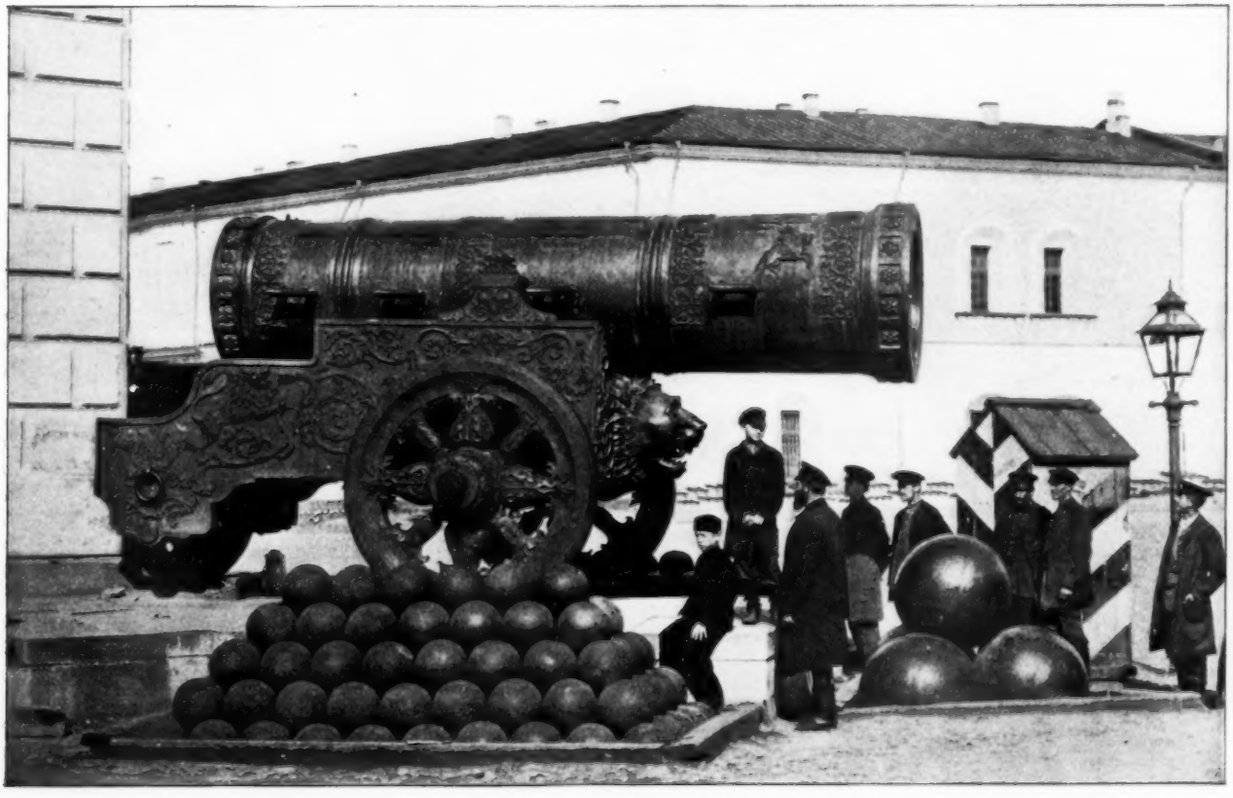
The Trans-Mississippi Exposition at Omaha will be notable for the illumination of the grounds and buildings, the plans in that respect being fully up to the scale established at the Chicago fair. Contracts have been awarded to the General Electric Company for 600 arc lamps, with the necessary generators for operating them, while the incandescent circuits will be supplied by generators and transformers of 840 kilowatts capacity. Two hundred and twenty-five kilowatts of current will also be supplied for power purposes.

MACHINERY STORE OF KOEPPEN & CO., MOSCOW, RUSSIA.



TSAR-PUSHKA.

Letters from Practical Men.

Screw Cutting with the Circular Saw.

Editor American Machinist:

While the circular saw is the Jack-of-all-trades among wood-working machines its use for cutting a screw is perhaps a novelty to most men. This job was successfully done by a Western machine

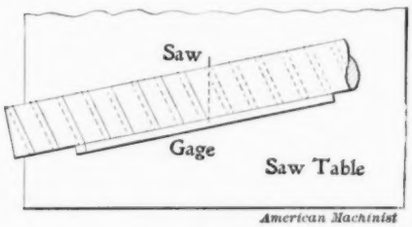


Fig. 1
SAWING OUT A SCREW.

shop, which, after the manner of its kind, took at a low figure an order for a large helical grooved drum, and then started to find a way to sweep the drum without sinking all the profit in sight. The pitch of the thread required was 2 inches. No lathe with gears or power to cut so large a thread was at hand. But as the casting was the only thing to be managed, the drum not being machined on its surface, the ingenious superintendent, whose fertility of resource has long since placed him among the first of the engineers of his State, turned to the handy circular saw as the means of making the spindle for the molder's sweep.

A wooden cylinder, about 4 inches in diameter and 3 feet long, was first turned up, and on its surface two helices of 2-inch pitch were laid out, by spacing off points on a series of parallel lines, in the well-known way. These helices indicated the desired width and position of the future thread. The circular saw was now lowered so as to protrude through the face of its table half an inch, the desired depth of the thread. The fence was then set across the line of the saw, at an angle to correspond to the helix on the wooden cylinder, and at such a distance that the saw would revolve directly under the center of the cylinder when the latter was held against the fence. The cylinder was then placed against the fence and lowered onto the saw, so that the latter cut into the wood along one side of the desired thread, and, by revolving the pattern against the fence, in the direction in which the saw would tend to roll it, a helical saw-kerf was produced. The remarkable thing about this simple process was that the saw ran almost without guiding on the desired line, so that the thread produced was true to pitch and smooth. Both sides of the thread having been sawed, the wood in the space between the threads was cut away by repeated sawing, and a little sandpapering of the piece in a lathe finished the job as well as could be desired. The wooden pattern thus finished was used for molding a spindle, and the iron casting thus made was put in a lathe and turned off along the top of the threads. A cast-iron sweep arm was next made, and the nut for the spindle was formed by babbitting the hollow hub of the arm on the iron spindle as a mandrel. As the hub of the arm had been made in halves, it was easy to remove it after babbitting, and then to put it together and bore out the inside of its threads. It will be noticed that when this nut was replaced it fitted on the outside diameter of its threads only, which had just been poured against the trued surface of the spindle threads, and thus the sweep had a steady bearing on the spindle, and the side bearing on the threads was quite accurate enough for the purpose. The sweep arm carried a template to form in the mold grooves in the surface of the drum, and no trouble was experienced in the molding.

This ingenious process was made up of very simple steps; but the work could hardly have been done in any cheaper and more generally suitable way. The man who could devise such a method on demand surely deserves his present reputation. The two accompanying sketches will doubtless make the operation clear without further explanation.

STERLING H. BUNNELL.

Lockport, N. Y.

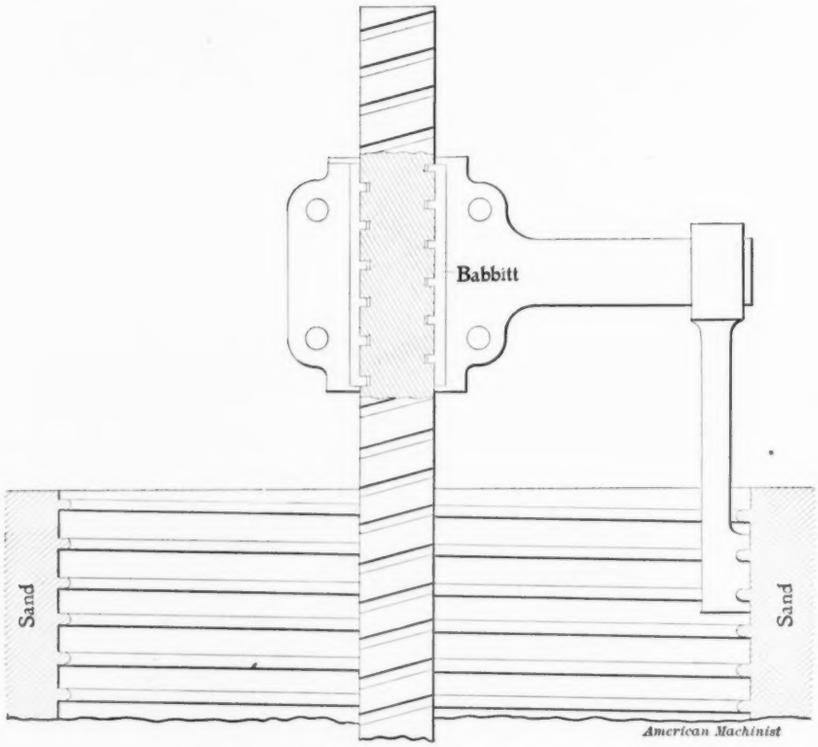


Fig. 2
SWEEPING MOLD FOR CHAIN DRUM.

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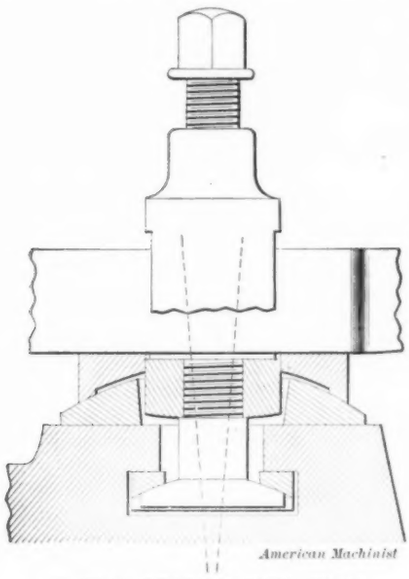
A Complete Ball-Bearing Tool-Post.

Editor American Machinist:

It is a rather striking circumstance that the ball-bearing comes in both for making things run easily and also for holding things firmly, securely and in just the position that they should be. That tool-post shown in your issue of February 17 is evidently well intentioned, and is all right enough as far as it goes, but it stops short of perfect excellence. The ball bearing at the bottom is right enough, but the wedge ring (not shown) which the tool bears upon above does not correspond with it very well. I have had enough experience with the wedge ring to know that nobody ought to be satisfied with it, and nobody ought to use it in these days. By turning it around you can get the tool to pitch all right in one direction, say lengthwise of the steel, but then it is almost always wrong sidewise. It is very certain that it will give you the desired pitch only in one direction, while it is equally certain that it will not at the same time give the right pitch at right angles to that first direction. It will pitch the tool say too much to the right; you can usually turn the ring around until the tool will pitch just as much too far to the left, and that is all the choice there is in the case.

The tool-post arrangement in the

sketch herewith is, I claim, a perfect ball bearing, whether it is at the same time the most perfect mode of setting and securing a tool or not. The contact surfaces of the collars above which support the tool and the surfaces in the slot below, which take the pull of the tool-post, are spherical and concentric. The tool



A BALL BEARING TOOL POST.

may be pitched in any direction all around the circle, at least as far as indicated by the dotted lines, and it will always have a perfectly flat and natural bearing, and it will be held securely. It is not usually necessary to give very much pitch to a tool in any direction, but the pitch that is necessary is very much needed indeed.

MORRIS FULTON.

▲ ▲ ▲

Laying Out an Elliptical Gear.

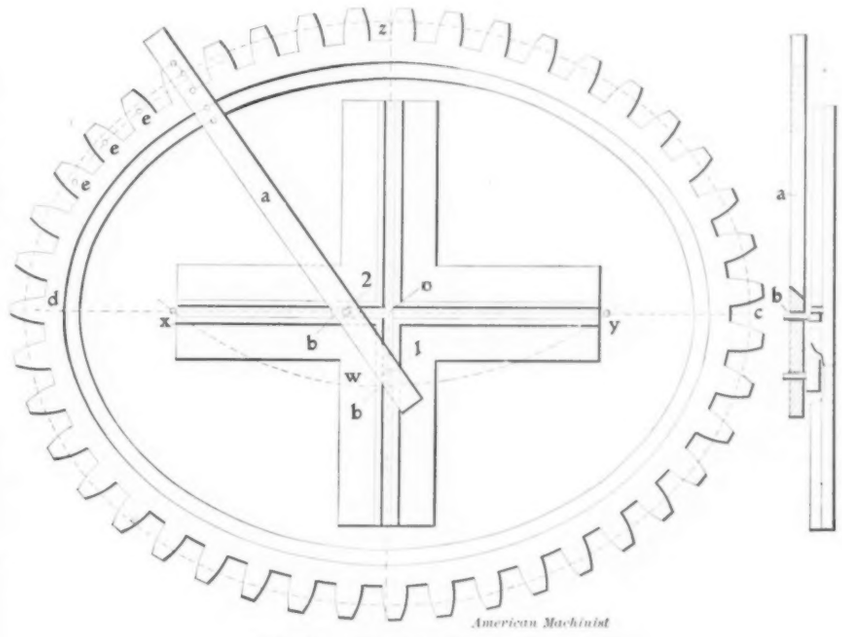
Editor American Machinist:

Mr. M. H. Avery, in your issue of January 6, 1898, and Mr. Frank Richards, in that of April 22, 1897, give interesting and instructive articles on elliptical gears, and their methods may be all right for drafting purposes, but when it comes to making patterns for such gears, and having to lay out ellipses on wood and work to them, their methods would hardly be practical. I have in my experience made a number of elliptical gear patterns, and I have found that the old reliable method is the best and surest way. I send herewith drawing of a trammel, or ellipsograph, which is very easily made, and which will give good results both on paper and on wood. The cross is of cast iron and the grooves are planed in at right angles. For temporary jobs I have made several such frames of small square pieces of wood, and sawed the grooves in on an ordinary buzz saw. The arm, *a*, is only a small strip of wood, with holes, 1 and 2, bored to fit loosely over the pins or slides *b b*, with distance between the centers just one-half the difference between the major or minor axes; then by boring holes wherever you want lines, and using pencil, pen or scratch awl, you have the whole outfit, and anybody can make a true ellipse.

The foci, *x* and *y*, are found by setting dividers to half the major diameter, *o d*, and with *z* as center, describing arc, *x w y*, cutting the major axis in *x* and *y*, either one of these foci may be used for the center of the shaft. EZRA ESTEP.

Sandwich, Ill.

[It may be proper to give in connection with this a few particulars which the writer has neglected. The major pitch diameter was 15⅜ inches and the minor 12⅜ inches. Then the distance 1-2 was of course 1½ inches. In laying out the teeth, the pitch line was divided equally all the way around, starting at *d* as the center of a tooth, the number of teeth being 43. It is customary always to use an odd number of teeth for a gear of this character. The sides of the teeth were described from points *e e e* on a line about ⅛ of an inch within the pitch line. The points of the teeth and the bottoms of the spaces were thus smaller at the long diameter of the gear than at the short diameter. This is, of course, as it should be, while by the method of cutting a circular ring with correctly shaped and spaced teeth all around and then bending the ring to the elliptical shape, as previously described in our columns, the teeth must necessarily be still all alike, and also the bottoms of the spaces, which is not, at least theoretically, correct. The ratio of *d y* to *y c* is 4 to 1. The cut is about one-quarter size.—ED.]



LAYING OUT ELLIPTICAL GEAR.

Demagnetizing Watches.

Editor American Machinist:

A simple method of curing magnetized watches which, I think, is not generally known, has been used by my partner, Mr. De Puydt, ever since he made his first dynamo (over twenty years ago). It consists of hanging the watch to a string, twisting the latter, holding string and watch near a magnet or dynamo, releasing the watch and, while it is revolving, carrying it away (not too abruptly) from the magnet or dynamo.

The demagnetization is due to the rapid alterations of the poles of all the magnetized parts in a magnetic field that is decreasing in force.

M. PONCIN.

Birkenhead, England.

▲ ▲ ▲

A Handy Bench Vise.—Molding Sheaves.

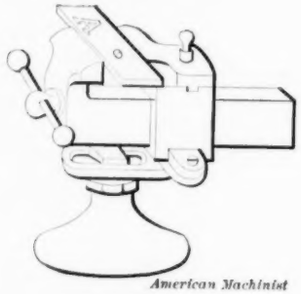
Editor American Machinist:

I hand you herewith a couple of sketches that may be of interest to your readers.

Fig. 1 shows a useful tool to have lying around the toolmaker's bench. It consists of a Prentiss jeweler's vise mounted on a stand. This little apparatus has more uses than a monkey's tail, holding little jobs for drilling, engraving, hand-routing, etc.

Fig. 2 intends to show about as measly a job as ever gets into a foundry, and I suppose every foundry gets it; at least I suspect so, as we frequently see a plan for making sheaves appear in the papers. We had a lot of them to make a short time ago, and, as the machinist hates to

make cores, we evolved the following plan, which filled the bill exactly: First we made the core box, and encircling the lower bottom we introduced a circular lifting ring, several of which were cast previously. After the green sand was packed into the core box and on to the ring the center part of the core box was lifted out, and then the core was

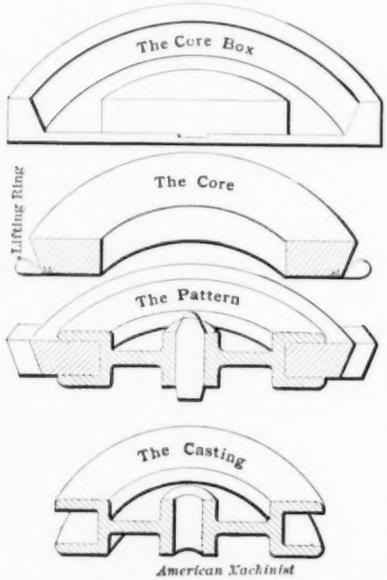


HANDY BENCH VISE.

lifted out by the ring. The pattern and print were made as usual, excepting that on the print two opposite lugs provided a place in the sand whereby the core ring could be let down by the fingers. I suppose there are other and better ways of doing this job, but as yet I have never seen work come out in nicer shape than did these. L. C. SHARP.

Omaha, Neb.

[Speaking of vises, a very handy one for light work in various positions, and one which stays where it is put, has a



MAKING SHEAVE WITH GREEN SAND CORE.

very heavy hemispherical base, to which the vise is firmly secured. This base fits into a corresponding concave bed, and the vise can be tipped or turned just as may be required. We saw several of them lately in the die shop at Billings & Spencer's, Hartford, Conn.—ED.]

Careful Adjustment of Temperature for Soldering Aluminum.

Editor American Machinist:

Apropos of your article in issue of February 10 on soldering aluminum, I send some notes on results reached by me in experiments extending through eight months in 1894. We were then considering the use of aluminum in the product of the works where I had charge. To be satisfactory it must be capable of being soldered into water-tight joints (to be tested at about 25 pounds pressure), and, of course, the joint and adjacent sheet metal must be as strong as the rest of the metal which had been untouched by the flame.

I found nine different parties who offered aluminum solders. Eight of these claimed to have the "only satisfactory aluminum solder," and analyses showed them to vary in the elements or in the proportions of their composition. Six were found experimentally to make strong joints, but only caught in places. So, thinking that the difficulty lay rather in the manipulations involved in the soldering operation than in the exact elements in combination, or in the proportions used, we made further careful experiments in this direction, and found that we could make tight joints with several of the solders, but that satisfactory results could not be reached with anything like the same ease and facility that could be obtained in soldering brass or copper, and that the particular difficulty lay in the small range of temperatures at which the solder could be worked, and that this range was much less than was available with either brass or copper. In other words, without such close attention as would make it a laboratory rather than a workshop process, the metal would be either seriously injured in strength and texture by overheating, or else would be too cool to make a continuous joint.

Having reached this point the next question was to consider how to arrange an apparatus, not too delicate for workshop use, which would instantly indicate the changes of temperature through the range intended to be used, so that the workman might govern his heating accordingly. I went far enough with this to satisfy myself that it might be done, but did not work it out, because other experiments made at this time showed that the use of aluminum in salt water was of doubtful value, owing to the corrosion which takes place. I do not know whether this corrosion is due to the presence of the small percentage of other substances (as claimed) in commercial aluminum or to the aluminum itself; but it was sufficient to make us decide not to use aluminum for the proposed purpose, and so I dropped the whole matter.

It will be noticed from the foregoing that workshop results can be reached when the object is only to fasten two pieces together, such as fastening a handle to a cup, without meeting such serious difficulties as when seeking to make strong water-tight joints; but even then the manipulation requires much more care and attention than ordinary soldering. C. M. SPALDING.

▲ ▲ ▲

Final Temperature of Compressed Air.

Editor American Machinist:

Do you not think that question No. 14 of last issue could have been answered in a much simpler way for the engineer? In this case negative characteristics are entirely avoided. From formula

$$t = t_o \left(\frac{P}{P_o}\right)^{0.29}$$

where t_o = absolute initial temperature
t = absolute final temperature
P_o = absolute initial pressure
P = absolute final pressure

Then we have if we substitute

$$t = 521 \left(\frac{164.7}{14.7}\right)^{0.29}$$

$$= 521\ (11.204)^{0.29}$$

log. 11.204 = 1.04937 which, multiplied by 0.29 = 0.30432, the log. of $(11.204)^{0.29}$ corresponding to 2.015 + then

$$t = 521 \times 2.015 + = 1050$$

G. A. G. GOULET.

Montreal, Canada.

▲ ▲ ▲

Applications of Electrical Energy.

The concluding lecture, at the American Museum of Natural History, on February 26, of the Columbia University course on "Mechanical Engineering," by Prof. W. A. Anthony, was not less interesting than those which preceded it. The lecturer's special topic, which was closely adhered to, was the "Applications of Electrical Energy." This is the day of cheap electricity, and the cheapness has been perhaps the most important factor in promoting its wide and wonderful employment. The dynamo actually makes or generates electricity; we do not draw it from any natural source or reservoir. We make it as we use it, and we use it as we make it. We cannot store it and use it as we want it. The storage battery does not store electricity, but rather stores a concentrated means of generating it.

The lecturer gave quite a variety of illustrations of the applications of electricity, beginning, naturally, with the electric light. The objectionable feature of the electric light is that so much of the cheapness of the electricity is lost by it. In the light we want light only; but by our methods thus far we develop

heat as well as light, and more heat than light, the heat being absolutely wasted, and worse; so that the arc light realizes only about 10 per cent. of the fuel value behind the dynamo, and the incandescent lamp only 5 per cent. Glow worms and fireflies produce light without heat, and consequently cheap light; and electricians are trying to do the same, but as yet with no great success.

In the application of electrical energy for heating purposes, although there are already such practical applications, as for instance, for heating irons for ironing in hat factories and in laundries, for all styles of cooking, for heating surface cars and similar uses, the cost of heating, or the wasteful mode of generating the heat, is still sufficient to prevent any general adoption of such means. For heating a surface car by electricity the cost in snug winter weather would seem to be as great as per car propulsion, while we know that a very little stove in the corner, heating directly, does the work at little cost.

In the numerous applications of electric energy for driving machinery or for producing rotary motion for every conceivable purpose it is at its best, and such applications are so familiar as to require no mention here. A peculiar and unique feature of electric power transmission is to be noted in this connection in the ability of the motor to react upon the generator and cause it to do more and more work if required, up to the point of its own disablement by burning out, or to the exhaustion of the power which drives it. The steam engine cannot so react upon the boiler and cause it to give out more energy as emergencies may require.

Cheap electricity, as is well known, is being extensively used for the separation of ores containing magnetic constituents, but perhaps the most striking and revolutionary of all its applications is in the purification of metals by electrolysis. Native copper contains such impurities as silver and gold, and electricity works cheaply enough to make the separation of these metals and the purification of the copper thereby remunerative. The interior of a large building, suggesting a freight station full of cars, was shown, the cars being, however, tanks in which the process of decomposition, the precipipation of the impurities and the redeposition of the copper were going on under the action of the electric current. A subsequent operation took the sediment of the tanks and deposited the pure metallic silver which it contained upon traveling belts of the same metal. In the one establishment referred to the extent of the operations carried on and their commercial importance will be understood from the single fact that 60,000 ounces, or silver to the value of, say, $27,000 per day, is extracted.

American Exports of Machinery According to Countries.

The Bureau of Statistics of the United States Treasury Department has recently published its report on the exports of domestic merchandise for the fiscal year ending June 30, 1897, arranged according to the customs districts through which the various articles passed and the countries to which they went. The greater part of the machinery exports are included in a general class which comprises everything except engines, boilers, printing presses, sewing machines and typewriters.

Glancing over the list of countries to which this miscellaneous class of machinery, amounting altogether to $19,771,856, was exported, it may be seen that the portion which went to the United Kingdom was $4,956,211, almost precisely one-fourth. Germany came next with $1,920,838, about one-tenth, and Mexico fell not far behind it with $1,891,321. Russia received $1,074,128 worth, of which $736,218 went via the Baltic and White Seas and $337,910 via the Black. France, which, in its demand for machine tools, at least, has appeared to rank next to England and Germany among the European countries, makes a very poor showing with only $733,542, which is less than the share of little Belgium, $769,279. The Netherlands absorbed $297,557 worth; Sweden and Norway, $276,686; Austria-Hungary, $164,653; Denmark, $124,807, and Italy, $96,273. The total of Europe for this class, miscellaneous machinery, was a trifle over $10,000,000, and from our knowledge that metal-working machinery is being exported at the rate of about $4,000,000 a year—which is based upon the statistics given for the latter half of 1897—coupled with the assumption that most of the machine tools sent abroad are bound for Europe, we may judge that about one-third of the miscellaneous machinery shipped to Europe, as reported above, was metal-working. So these statistics are of considerable value in judging of the centers of greatest demand for our machine tools.

Among non-European countries, besides Mexico, which have bought largely of our machinery are the following: Dominion of Canada, $1,458,590; British Africa, $1,319,938; Japan, $909,031; British Australasia, $831,659; Guatemala, $328,634; Hawaiian Islands, $325,913 (which is an excellent showing); Brazil, $321,322; Argentina, $268,154; Chili, $141,040; Salvador, $111,836; Colombia, $109,715.

It can hardly be of interest to dwell upon the relative amounts of machinery which went through the various customs districts. Of course, New York took the lion's share with $13,472,976, out of the $19,771,856 of miscellaneous machinery, the next in value being Boston and Charlestown, Mass., with $1,340,102, just one-tenth of New York's business. The districts through which the most stationary engines passed were, next to New York, Detroit, Mich., and Paso del Norte, Tex.; but the number being only twenty in each of these two cases was too small to take as establishing a rule.

The total number of stationary engines shipped during the fiscal year was 423, and their value $323,438. Mexico took the most in number, amounting to 100; but their value, $46,412, was less than that of those sent to Argentina, $53,751, although the latter were but 23 in number. The United Kingdom got 62, but they were mostly small ones, being valued at only $25,205. Canada bought 55, Russia 18, and British Australasia 28. The rest were more scattering.

Of boilers and parts of engines Russia was by far the largest purchaser, with a valuation of $170,331. Mexico did passably well in typewriters, of which $25,298 worth were sent to that country—more than one would suppose they could find a use for down there—but the United Kingdom bought $731,152 worth. Japan did the best in locomotives, for it purchased 95 altogether. Mexico ranked next with 76; then came Russia with 60, Brazil with 38, Argentina with 13 and China with 12. Probably China did better than this during the latter half of the calendar year 1897. From the port of Philadelphia were shipped 112 locomotives, as against New York's 155, and we imagine that the Baldwin works have been building higher-priced engines than some others, for in valuation the Philadelphia and New York quotas showed little difference.

To sum up, cultivate the machinery trade with Mexico, Germany, Russia, Japan and all the British Empire.

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The electric lighting system of the Boston Electric Light Company is being reorganized by consolidating all the small stations into one having a total capacity of 12,000 kilowatts in four units. The main dynamos will be of the three-phase system and will serve the regular incandescent circuits directly. The arc lighting circuits will be supplied from generators driven by synchronous motors in the primary circuits instead of by independent engines, and the direct current power circuits will be supplied from rotary connectors. The contracts for the work have been placed with the General Electric Company.

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Breathes there a man with soul so dead,
Who never to himself has said:
"Were I paid according to my worth,
I'd have a mortgage on the earth."
—Chicago News.

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A Suggestion.

A kind of communication which we frequently receive is that which deals with the advantages to a mechanic of being a regular reader of the "American Machinist" and the disadvantages of not reading it. Many of our friends have very clearly set forth the many sides of this question at length, and have written their opinions for publication. If we were to publish articles calculated merely to gratify our personal pride we might make room for all of these, but our selection of matter for publication must of course not be based upon such grounds, and the difficulty with articles of the kind we refer to is that they would reach only those who for one reason or another are already readers of the "American Machinist," and who probably need no argument to induce them to continue doing so, while for those who dwell in outer darkness and never see the "American Machinist" there is no help, for such articles do not reach them. Therefore, probably the best we can do is simply to publish each week the best articles we can find or prepare that relate to the practice or the theory of machine construction, and we feel confident that most of those who are much interested in machine construction and who have the ambition to be intelligent and to keep up with the procession will, in some way, come to know the paper and to be regular readers of it.

The articles to which we first refer above are, of course, written with the best of motives, but in view of the fact that it is impossible for them to reach the targets aimed at, we would suggest that the best way in which our friends can be of assistance to us in building up and extending the influence of the "American Machinist" is for each one to occasionally call the attention of one or more shop friends or acquaintances to it, with the view of securing if possible an additional subscriber. If every reader were to do this our subscription list would be, obviously, about doubled, and those who put forth this effort in our behalf would have the satisfaction not only of knowing that they have possibly helped those who have become new subscribers, but that they have made it possible for us to make the paper still better, for it is of course a fact that the larger the subscription list of any paper the better that paper can be made.

Advice to read the "American Machinist" is all right, but to do any good it must reach someone who does not already read it, and the friendly word of a reader addressed to a shopmate or acquaintance must be for the future as it has been in the past the chief means of extending its field and of making further improvement practicable.

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Proposed Patent Legislation.

Inventors and manufacturers are making vigorous protests against the passage of the Reeves bill to amend the patent laws of the United States so as to allow the more reasonable use of inventions and discoveries by the people and to protect the patentee. The bill empowers the Commissioner of Patents to place a tax of from 1 to 10 per cent. of the estimated cost of production upon articles manufactured under patents granted under the act, such tax to be paid into the Patent Office. The bill also reserves to the United States the right to condemn patents at a fair cash valuation when it can be shown that the invention is of a character to be valuable to the people as a whole.

This seems like placing a great deal of responsibility upon the shoulders of the Commissioner of Patents and giving him authority over the business of others which he may be quite incompetent to exercise fairly. We suppose the idea of the bill proceeds from the common notion that a patent giving to an inventor the exclusive right to ownership of what he has himself produced, for a period of seventeen years, can in some way work injury to others, which is a wrong idea fundamentally, for it can do no such thing. People can go right on living and doing business as before and without using anybody's patent if they so choose, and they will do that unless the patent or the use of the patented article is offered to them upon terms which are advantageous.

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Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer questions by mail.

(20) R. R. R., New York city, writes: I have had a discussion with an engineer over the matter of steam pressure at the end of a long pipe connected with a boiler. This engineer claims to have found in his experience that if the steam in a boiler is, say 60 pounds per square inch, and is led through a pipe to a distance of 100 feet or more in a horizontal or perpendicular direction the pressure at the end of the pipe will be several pounds less than at the boiler, and the greater the distance the more the reduction in the pressure. He states that the reduction of temperature is the cause for the reduction of pressure. I maintain, however, that this cooled steam will still be driven along to the end of the pipe by the steam behind it and that the pressure will be maintained, and in fact that if the pipe descends from the boiler then the condensed steam, by its own weight, will add to the pressure in the end of the pipe so that it will be greater than the pressure at the boiler. Which of us is right about this? A.—You are both right, but you are talking about different things. The engineer probably bases his opinion upon the observed fact that where a length of pipe is used for conveying steam to an engine the pressure is seldom, if ever, fully maintained in the pipe up to the engine, the reason for this being that a part of the stored energy in the steam is used up by friction of the steam in the pipe. If, however, the end of the pipe is closed by a valve or otherwise the pressure will be as great as in the boiler, the action such as you describe being the one which actually takes place under these circumstances, and it is true that a pipe descending from a boiler and filled with condensed steam held in the pipe will show a pressure in excess of that in the boiler, such excess of pressure corresponding to the static head.

(21) "Ignorance," Baltimore, Md., asks (1) for a reference to books showing how to calculate moments of inertia. A.—You will find an excellent explanation of just what the quantity called moment of inertia is, as well as the method of calculating it, with approximate accuracy, in "A Simple Derivation of the Formula for the Strength of Beams," by Walter Ferris, published in our issue for April 16, 1896. The exact calculation of moments of inertia can only be made by the use of the calculus, though the method given by Mr. Ferris is accurate enough for all constructive purposes. Practically the calculation has seldom to be made, as the values of the moment of inertia for all ordinary sections are given in the various pocket-books and rolling mill hand-books. Its calculation for com-

pound or built-up sections is explained with great clearness in the book put out by the Pencoyd Iron Works. (2) In designing the bracket in your paper Vol. 14, No. 9, how is the diameter of the bolt calculated that fastens the ends? To what strains is it subjected? A.—The strain on the bolt is a shearing strain whose value is shown by the line $b\ c$ of the diagram in the article cited. (3) In Wentworth's "Analytic Geometry" I find the following problem; please explain how to solve it: What value must C have in order that the line $4x-5y=C$ may pass through the origin of co-ordinates? A.—Transpose the equation to read $4x=C+5y$. In order that the line may pass through the origin, x and y together must be equal to o. This can only be true when $C=o$, since for any other value for C, a value o for y will give a numerical value for x, and a value o for x will give a numerical value for y. (4) Please explain the common meaning of the following symbols: δ ω. ∞. Δ. f, Σ. Are they first used in algebra, geometry, trigonometry, analytical geometry, or the calculus? A.— δ and ω are Greek letters (delta and omega), which are used in formulas in a manner similar to ordinary letters. They are often used to designate angles, as are several other Greek letters, especially α (alpha). The symbol ∞ is used to designate infinity. Δ is the Greek capital δ. It is used in the elementary demonstrations of the differential calculus, where it is always followed by another letter, as Δx. the entire expression meaning the difference between two near values of x. When these near values of x become successive, or when the difference between them is infinitesimal, Δx becomes $d x$. That is Δx means the difference between two values of x, which difference, while small, is appreciable and measurable, while $d x$ means a difference which is so small that its value cannot be measured or conceived—that is, it is infinitesimal. f is the sign of integration. Σ is the Greek capital letter sigma. It is used as a sign of summation of a number of values of the same quantity. Thus Σx means the sum of various values of x. In this connection its meaning is analogous to f, which latter designates a true or exact integral or sum of all possible values of the quantity, while Σ means the sum of a limited number of such values, the value of such sum approaching the true integral as the number of values added together is increased. In the article by Mr. Ferris, equation (1)

$$WI = \text{sum}(S_1 f_1 c_1 + S_2 f_2 c_2, \text{ plus all the others})$$

might have been written

$$WI = \Sigma(S f c)$$

and could an infinite number of values for S f c have been taken, the result would be a true integral. In other words, Σ indicates an approximate integral. But few exact integrals are known and the process of summation represented by Σ is often used when exact integration is impossible.

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American Ship Building.

Our readers will recall our editorial of February 24 on "The American Merchant Marine," in which we expressed the conviction that the reduced cost of all forms of iron and steel in this country is destined to lead to a revival of ship building on these shores.

By a curious, and to us gratifying, coincidence, a similar opinion is advanced by Andrew Carnegie through the "Iron Trade Review" of March 3. If any man in the world may be said to speak with authority in such matters it is Mr. Carnegie, and that he should express such an opinion is in the highest degree significant. His argument is essentially the same as ours, with the addition of figures. He states that ship plates are worth $7 per ton less in New York than in Glasgow, while other materials, including woodwork, are correspondingly cheaper here. He is also convinced of the cheaper cost of labor compared with output here, saying that "If a yard were built to-day with the newest appliances, the total cost of labor, even at much higher wages, would be less than in any shipyard I know of, either in Great Britain or Germany."

In Mr. Carnegie's opinion, the vicinity of New York is the proper location for such a shipyard, because of the great amount of repair work here obtainable, the demand for a dry dock, which would be a necessary part of the plant, and the prospective cheapening of freights from Pittsburg through the enlargement of the Erie Canal, which, he states, will, within two years, reduce the cost of transporting steel from Pittsburg to New York to $1, or less, per ton. He believes that the difference in the cost of steel here and abroad is to be permanent, and says that steel manufacturers would be justified in guaranteeing the present prices for a term of years.

Mr. Carnegie has obviously a high opinion of the ability of the great lake shipyards, of the magnitude of which most Americans have but little conception—and his letter is sent to a Cleveland paper in order to put the matter immediately before the proprietors of those yards.

The great industrial opportunities before the American people cannot be called to their attention too often or too forcibly. The near future is to see this country the workshop of the world. The handwriting is upon the wall for all to read who will. Foreign complications or domestic politics may delay its consummation, but cheap iron, cheap coal and our highly developed methods of manufacture can have but one eventual outcome. Let our people wake up to the situation, which offers opportunities greater than were ever possessed by any people since time began.

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Personal.

Chief Engineer W. B. Dunning's sick leave is revoked, and he has been placed on waiting orders.

Passed Assistant Engineer G. E. Burd, U. S. N., has been ordered to temporary duty at New York.

Kindly oblige us by sending in personal items regarding changes of foremen, superintendents and others prominently connected with the machine business.

Passed Assistant Engineer F. C. Bieg, U. S. N., has been detached from Dialogue's works, Camden, and ordered to the "Katahdin."

Passed Assistant Engineer C. H. Matthew, U. S. N., has been detached from the New York Navy Yard and ordered to the "Miantonomoh."

Chief Engineer W. M. Parks, U. S. N., has been detached from inspection duty at the Columbia Iron Works and ordered to the "Miantonomoh."

Passed Assistant Engineer J. K. Robinson, U. S. N., is ordered to the navy yard at League Island, and his unexpired leave of absence is revoked.

John Walker has resigned his position as general manager of Fraser & Chalmers to give personal attention to mining properties he has become largely interested in near Deadwood, S. Dak.

Mr. F. A. Pickens, lately with the United States Naval torpedo station, Newport, R. I., has recently accepted a position as foreman with the Fox Machine Company, Grand Rapids, Mich.

Mr. Eugene Seavey, formerly foreman for E. H. Pearson, 76 Sudbury street, Boston, Mass., has accepted an appointment as master mechanic for the Desmond Manufacturing Company, of New York.

On February 1 Mr. M. E. Hershey, general manager of the Harrisburg Foundry & Machine Works, Harrisburg, Pa., severed his connection with that company, and Mr. W. R. Fleming, of the firm of W. R. Fleming & Co., of New York, Boston and Philadelphia, has accepted the position of vice-president and general manager of the Harrisburg Foundry & Machine Works. This change took effect February 1.

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Inquiries for Machinery.

Those who make, or may know of the makers of such machinery as is called for below, will oblige us by sending name and address, mentioning the number of the inquiry. We cannot forward catalogs. We have inquiries as follows:

36. From Italy, for flexible couplings for connecting turbine and electric generator shafts.

37. From Italy, for machinery for making paper buttons such as are worn on shoe uppers, gaiters, children's leggings, etc.

38. From England, for the makers of brands of steel known as the "Spartan" and "Standard," used as stock in automatic screw machines.

39. From Germany, for complete plant for making butt and lap-welded wrought iron pipe from ⅛ inch to 4 inches inside diameter.

40. From England, for all kinds of

machines for making wheels for road vehicles—*i. e.*, wood wheels.

41—For the name of the maker of the Bogardus eccentric mills, used for grinding clay, charcoal, asbestos, etc.

42—A small motor to work by gasolene, and suitable for a light carriage.

43—For motor cycle, capable of taking place of horse and buggy on dirt roads, and reasonable in price.

44—For presses and dies, such as are used for the manufacture of decorative floor and wall tiles.

45—A correspondent wants repairs for the Hotchkiss cushion hammer, and wishes to know where he can obtain them.

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Obituary.

Chief Engineer and retired Lieutenant-Commander William H. Rutherford, of the United States Navy, died in Harrisburg, Pa., on March 1. He was born in Philadelphia in 1828, was appointed Third Assistant Engineer in 1849 and commissioned Chief Engineer in 1861. He served on many vessels and had a wide range of experience. He was attached to the "Mississippi" on the Japan expedition, 1852-56, and in the civil war was successively on the "Pawnee," the "Mississippi" and the "Wachusett." He was retired in 1874 for disability incurred in the line of duty.

James H. Carpenter, inventor of the Carpenter projectile, died on the 6th inst. at Reading, Pa., of pneumonia, aged 51 years. He was born in New York, entered the Naval Academy, and served with distinction in the navy during the civil war. In 1888 he established the Carpenter Steel Works at Reading, and became general manager. This enterprise met with great success. The company has filled large Government contracts for projectiles. Mr. Carpenter retired as manager a year ago, and since then had made experiments in steel improvement in New York. He was an authority on matters connected with iron and steel and had written on scientific subjects.

Dr. W. A. Rogers, Professor of Natural Philosophy and Astronomy in Colby University, Waterville, Me., died on March 1. He was born in Waterford, Conn., in 1832 and was graduated from Brown University in 1857. He taught mathematics and astronomy in Alfred Academy, was an assistant in the observatory of Harvard College, then Assistant Professor of Astronomy in that institution and in 1886 he assumed the position which he held to the end of his life. Professor Rogers, besides being an able instructor, was a marvelous mechanic, and his instruments and methods for minute precision in measurement and graduation had secured for him a world-wide reputation. In 1895 his personal mechanical laboratory and workshop was totally destroyed by fire, involving the loss of his large screw-cutting engine, machine for testing screws, machine for grinding screws, and, most valued by him of all, a reversible sectional nut used for correcting errors. Other machines and small tools were all destroyed with no insurance, and no attempt was made to start again upon the same lines. Professor Rogers was a member of the American Society of Mechanical Engineers, Fellow of the Royal Society of London, Member of the National Academy of Sciences, vice-president of the American Association for the Advancement of Science and president of the American Society of Microscopists.

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Harland & Wolff Boycotted.

The boycott which we referred to some time ago as being proposed against the Belfast ship-building firm of Harland & Wolff has, it is reported, been actually instituted by those firms in Great Britain who fought and defeated the engineers' organization by means of a sympathetic lockout in which Harland & Wolff refused to join. No doubt Harland & Wolff are aware, however, that ships' plates and most other ship material can be purchased here as cheap or cheaper than at home, and we should think this boycott might easily prove a good thing in the way of helping along the introduction of American plates in Great Britain.

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Commercial Review.

NEW YORK, Saturday Evening, March 4, 1898.

DYNAMOS AND MOTORS.

The tone of business continues excellent, with the companies still hard at work and with flattering prospects for the spring. Some indeed have found it not quite so active during the last few weeks as hitherto, but they do not seem to be in the majority. There is, however, a slight tendency toward hesitation, owing to the uncertainties of the Spanish question. We might have commented upon the war scare before, but have been too lacking in humility to enter the ranks of the "Maine Extra!" and "War Sure!" journalists. Since it seems to be a fact, nevertheless, that some real business men are allowing themselves to be influenced in their commercial transactions—though not much, thank fortune—by the present wave of bellicosity, we might as well allude to the circumstance. If, in the next century, or at any other time, war should arrive it might become a source of some immediate profit to manufacturers of electrical as well as other kinds of machinery, because military exigencies would create a demand for a great variety of apparatus. But, as one of the best known tool builders remarked to us the other day, it would not be a desirable sort of a demand.

Prices have been manifesting some weakness of late. Sharp competition seems to be the cause of it.

The representative of one company speaks of there being at present a notable inquiry for arc-lighting machinery for small municipal plants. Another comments upon an improvement in the demand for goods from the central West; for instance, the State of Illinois.

Several companies are now meeting

Continued on page 35.

Business Specials.

Gear wheels, gear cutting. Grant; see page 16.

Power hammers, Jenkins & Lingle, Bellefonte, Pa.

Forming Lathes. Mer. Mach. Tool Co., Meriden, Conn

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y

Wants.

Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Situations Wanted

Mechanical draftsman, 7 yrs. exp. Box 96, AM. MACH.

First-class mechanical draftsman of experience and education. Box 124, AMERICAN MACHINIST.

Mechanical draftsman wants position; 9 years' experience. Address Box 115, AMERICAN MACHINIST.

Draftsman and machinist, exp. in general machine works, wants situation. Box 113, AM. MACHINIST.

Position as foreman machinist; 20 yrs.' exp., 8 yrs. foreman; reference. Box 121, AMERICAN MACHINIST.

Mechanical engineer, 12 years' exp., tech. educ.; thorough on water tube mar. boiler. Box 123, AM. MACH.

Young man desires position to take charge of screw machine; good reference if required. Address Box 128, AMERICAN MACHINIST.

Wanted position by three first-class tool and die makers familiar with combination die work. Box 110, AMERICAN MACHINIST.

Graduate M. E., some shop experience, four years' superintendent light manufacturing plant, desires position. Box 118, AMERICAN MACHINIST.

Change wanted by an American, practical all-around machinist; exp. in air at high pressures; experimental work preferred. Address Box 117, AM. MACHINIST.

Situation as foreman or supt. by practical man; up on modern methods and able to get out work at lowest possible cost; ref. Box 114, AMERICAN MACHINIST.

A shop superintendent of one of the most successful turret lathe builders desires a change; nine years' in present position; best ref. Box 130, AM. MACHINIST.

Mechanical engineer and draftsman, 35, college graduate, is open for engagement; position with foundry and mach. co. pref.; ref. Box 127, AM. MACH.

First-class mach. and tool maker desires steady position as foreman; small mach'ry pref.; fair draftsman and designer, exp. as foreman. Box 120, AM. MACH.

Engineer, who has had charge of building one of the largest beet sugar plants in Sweden, wishes to meet with parties intending to build new plants. Reinhold, 439 Henry Street, Brooklyn.

Position wanted by tool maker, 30 years; accustomed to all kinds of automatic machinery, gig and die work; experienced in bicycle, typewriter, and fine tool work. Box 111, AMERICAN MACHINIST.

Wanted a position as supt. or mgr. of a well established machine works, by M. E., with view of introducing a special machine to build something entirely new. Address Box 122, AMERICAN MACHINIST.

Loam molder wants position as foundry foreman; 24 years' experience; all kinds of heavy marine and land engine work; reliable and sober; can be well recommended. Box 119, AMERICAN MACHINIST.

Wanted, by tech. graduate, with a first-class practical experience, position as instructor in manual training or mechanic arts; can teach physics, mechanics, machine design, etc. Elmwood, AMERICAN MACHINIST.

Draftsman or salesman, tech. graduate, 6 years' experience in shop and drafting room; ice machinery, looms, automatic screw machines; past 2 yrs. draftsman for large bicycle plant; familiar with bicycle construction, tools, jigs, etc.; best ref. Box 131, AM. MACH.

Help Wanted.

Wanted a first-class machinist tool salesman for Philadelphia and vicinity. Box 112, AM. MACHINIST.

Wanted first-class erecting shop foreman. Address the Bucyrus Company, South Milwaukee, Wisconsin.

Wanted an instructor in pattern making and foundry work. Address, stating experience, age, salary, etc., Box 94, care of AMERICAN MACHINIST.

Wanted—First-class tool-maker; give past connections, kind of work engaged upon and wages expected. Bickford Drill & Tool Co., Cincinnati, Ohio.

Help Wanted.—Continued.

Wanted at once 20 first-class machinists, accustomed to large engine work or heavy machine tools, for night work. Box 129, AMERICAN MACHINIST.

Wanted foreman for machine shop; one who has had experience on accurate interchangeable work; must furnish best of refs. Ad. Box 116, AM. MACHINIST.

Wanted foreman for a large mach. shop to build horizontal stationary eng.; straight line and duplex, both small and large; age and ref. req. Box 126, AM. MACH

Wanted a capable and energetic salesman on mach. tools to travel in New England and Middle States, with headquarters at New York. Address, stating age, experience and salary expected, Box 125, AM. MACHINIST.

Wanted—A salesman for special line of machine tools; must be a good mechanic, having experience in the use of turret lathes, automatic screw machines, milling machines, and in designing and making tools. Box 77, AMERICAN MACHINIST.

Wanted by an established concern a machinist, molder and pattern maker who can together raise $5,000; must be first-class men, competent to take charge of their respective departments; dividend guaranteed; none but first-class men of sober and steady habits need make application; work in general mill and mining machinery. Ad. Opportunity, AM. MACH.

Foreman wanted—An energetic, thoroughly practical mechanic, familiar with the manufacture of sewing machines, typewriters, firearms, or other articles of like character, who has had a successful experience as foreman, and is acquainted with up-to-date appliances for economical manufacture, and fully competent to obtain the most satisfactory results from facilities furnished. Address, with references, stating age, experience and salary expected, Practical, care of AMERICAN MACHINIST.

Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Wanted—Lathe and planer. 7 Quay street, Buffalo.

Book, Dies & Die Making, $1. J. L. Lucas, Prov. R. I.

For selling or buying tools apply J. Klein, South Parade, Manchester, England.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

Emery Wheel Dressers; send for sample and price. Manufactured by Geo. H. Calder, Lancaster, Pa.

Wanted—The latest improvement in gas and gasolene engines. Address F. C Austin Mfg. Co., Chicago, Ill.

For Sale—Second-hand drill presses, engine lathes and planers. Dietz, Schumacher & Boye, Cincinnati, O.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co., Springfield, Mass.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Machinery dealers wanted as agents in New York, Boston and Philadelphia to handle our automatic engines, etc. Clark Bros., Belmont, N. Y.

Wanted complete equipment of machine shop tools, including lathes, planers, drill presses and boring machines. Address F. C. Austin Mfg. Co., Chicago, Ill.

Lathes, planers, drills, milling machines, vises, also brass working machinery second-hand; must be modern and in first-class condition. C. C. Wormer Machinery Co., Detroit, Mich.

If you use Brass, Bronze or Composition Castings in large quantities, write to us for prices. Jas. J. McKenna & Bro., 424 and 426 East Twenty-third street, New York. Established 1833.

Manufacturer desiring a specialty should investigate small auto. refrigerator machine using no ammonia; four patents pending; no experimental work required; best reference. Refrigerator, AM. MACH.

Wanted agency for England for thoroughly first-class feed water purifier and scale preventer. Advertisers have splendid connections among manufacturers. Full particulars to Filter, c. Mesars. C. Mitchell & Co., Red Lion Court, Fleet Street, London, England.

Brains and hands do their best work in the field of their experience. The Century Machine Co., 576 West Broadway, New York, employs trained brains and trained hands in the persons of mechanical experts who are competent to solve intricate mechanical problems and make operative models. The designing of automatic and labor saving machinery is in charge of Mr. Oluf Tyberg and assistants. The Century Machine Co. is equipped with most modern tools as well as men. Light machine work, experimental work, model making and manufacturing solicited.

THE CROSS OIL FILTER

actually reduces oil bills 50% or more. Sent on approval. Used in 17 countries. Testimonials from leading firms in every field of industry.

Business established eight years.

THE BURT MFG. CO.
AKRON, O., U. S. A.

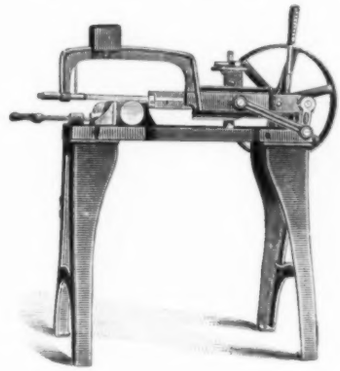
Largest Manufacturers of Oil Filters in the World.

"The best is as good as any."

The New

Automatic and Gravity **Feed**

Q & C Shop Saw

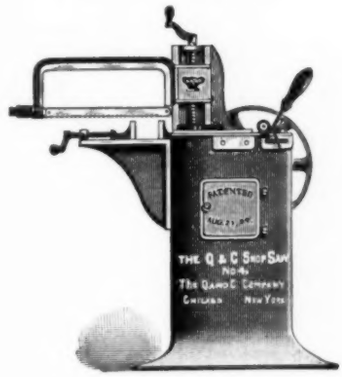


Cuts { Tool Steel, Machinery Steel, Iron, Brass and All Other Metals.

Price—'Way Down.
Quality—'Way Up.

Shop Saws,
Portable Rail Saws,
Cold Power Saws,

For All Purposes.



Send for Catalogue.

Q & C Company,

Chicago. New York.

LONDON: Chas. Churchill & Co.
PARIS: Hounsfield & Fils.
BERLIN: Schuchardt & Schutte.
MADRID: J. G. Neville & Co.

Continued from page 34.

with very favorable indications in exports. We have hints that there is some pretty important work in prospect abroad, presumably in the railway line, which it is desirable to keep shady while it remains in an immature state. One concern which has been exceptionally successful in the foreign field is coming to the conclusion that 'tis prudent to be reticent about its foreign aggressions, both in order to avoid giving cues to its competitors and to avoid hindering the work of the foreign corporations which are virtually its branches. If the home company keeps, as far as possible, in the background and allows the greatest amount of glory and individuality to its foreign counterparts or correspondents, so that the latter may be as little identified with Americanism as possible, it avoids a great deal of the national jealousy which impedes trade.

NOTABLE RECENT CONTRACTS.

In issues of our paper published since our last general report upon electrical machinery we have mentioned that the Metropolitan Street Railway Company, of this city, is expecting to install in its new plant a large amount of electrical machinery, to be made by the General Electric Company. Within a space of two days, about a week ago, the same electrical concern booked three other large orders for street-railway material. They came from the Cincinnati Street Railway Company, for over $100,000 worth of apparatus to change that portion of its road now driven by cable, the Walnut Hills line, to an electric system; from the Boston Elevated Railway, for apparatus amounting to about the same sum, and from the Consolidated Traction Company, of New Jersey, for $75,000 worth.

The Walker Company also is receiving some important contracts in the railway line. The Brooklyn Elevated has ordered from it somewhere about 150 car equipments, which will be applied to the Fifth avenue (Brooklyn) line when the arrangements are made to have its cars run over the bridge into the Borough of Manhattan. The Walker Company has also sold four very large dynamos to the Standard Light & Power Company, of Dallas, Tex. Two of them are two-phase, 60-cycle, 125-revolution machines, of 225 and 235 kilowatts capacity, to be directly connected to Erie engines, and the others are direct-connected railway generators, of the same respective capacity. It is building two alternating generators, 250 kilowatts capacity, of the belted type, for the North River Electric Light & Power Company, of New York city. Among other contracts taken by it are several good ones for export, including motors for the Glasgow Municipal Tramway, a generator for the electric railway of Alexandria,

Egypt; some 100 car equipments for Dresden, and goods for South America.

The C & C Electric Company notices that the export field is especially bright. It is not that any very large contracts have lately come in, but the inquiry is animated all over Europe. Among the orders received may be mentioned an electric hoist for shipment to England and reshipment to Australia. Business still comes from Japan. In the United States they are furnishing quite a number of 2 horse-power slow-speed motors to the Pope Manufacturing Company, Hartford, Conn., for use in electric carriages. These carriages will be handsomely built for use in fashionable summer resorts. The specifications for the motors are very rigid.

The Nichols Chemical Company, of Laurel Hill, L. I., is to install four 70-kilowatt direct-connected Eddy dynamos for electro-depositing use. These are said to be of unusally large size for that purpose.

At the beginning of 1897 the General Electric Company anticipated a good year in the general small supply business and therefore increased the estimates of what was expected from its various offices for the year. As it proved, every office sent in a volume of orders in excess of the estimates, and the total excess is said to have amounted, for the year, to nearly a million and a half of dollars.

It is stated that in the electrical machinery export business every American company experienced an improvement for the year 1897, as compared with 1896.

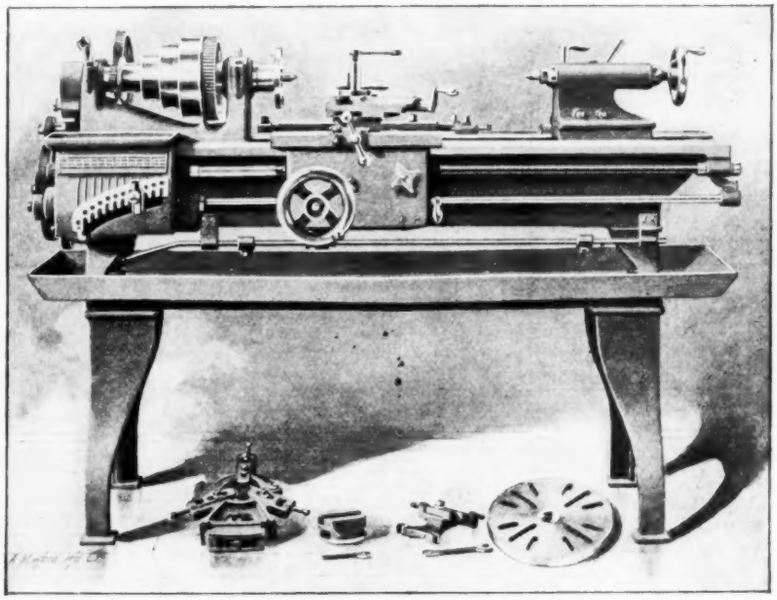
The Bullock Electric Company, Cincinnati, is building a new plant, and hopes to be running its new shops by July. It is at present so busy that July is its earliest delivery.

CINCINNATI REPORT.

The volume of business in pig iron transacted here during February was very fair, as compared with that of January, although the sales were not made in large quantities. The many big transactions made in January were at such low prices that producers became alarmed and feared demoralization; but arrangements have been made by which, for a time at least, it is hoped to secure uniformity. In finished forms of iron and steel February's trade exceeded that of January. Manufacturing lines showed excellent tone. Orders received manifested improvement as compared with the first month of the year, indicating the approach of still better conditions in iron, steel machinery, machine tools, engines, and other lines.

If space permitted we could print many bright reports received from manufacturers of machine tools and allied lines showing an increase in their business since the first of this year, as well as by comparison with the winter of 1897. A factor common to the experiences of

12=in. Hendey=Norton Tool=Room Engine Lathe.



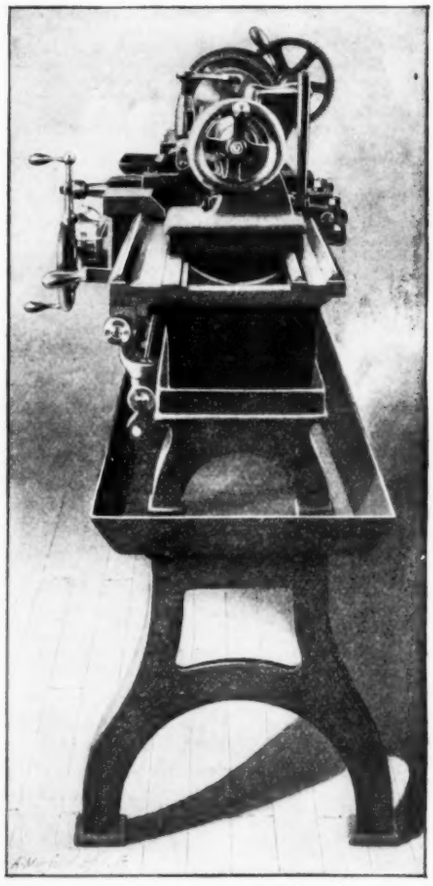
Complete in every respect as our larger sizes of lathes.

Especially designed for work in tool-rooms, experimental stations, and fine machine and repair shops. Fitted with either rise and fall or plain carriage. With or without improved taper attachment in connection with plain carriage.

This Lathe can be fitted with wire chucks in any decimal under half inch, which are invaluable for finishing small taps, reamers, special screws and studs, and other work right from the rod—no cutting off and centering of work required.

Cross-feed screw graduated to thousandths of an inch.

Beds made in 4 ft., 5 ft., and 6ft. lengths.



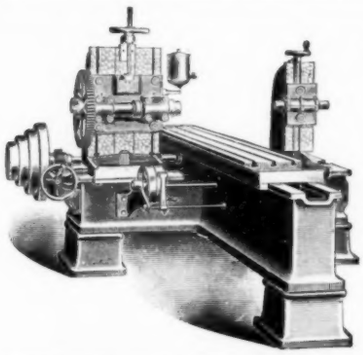
END VIEW OF THE HENDEY-NORTON ENGINE LATHE.

The Hendey Machine Co.,

TORRINGTON, CONN.

Agents for the Pacific Coast: Pacific Tool and Supply Co., San Francisco, Cal.
J. W. Cregar, Philadelphia Bourse Exhibition.

European Agents: Schuchardt & Schutte, Berlin, Vienna, Brussels, Stockholm; Chas. Churchill & Co., Ltd., London and Birmingham, England; Adolphe Janssens, Paris, France.



Power Milling Machines

1894 MODEL.

Made in two sizes with *single head*, with foot-stock as shown in cut or without it, with *overhanging arm*, also with *two heads*. The *Tables* are driven by a large, powerful worm engaging with a rack screwed to table, and have automatic adjustable stop motion, also *patent adjustable stop mechanism* which allows the work to be run up to the cutters without breaking the teeth. Machines, of similar style, made in two larger sizes, with table feed in either direction of travel. Ask for the "Machinists'" Catalogue.

THE PRATT & WHITNEY COMPANY,
HARTFORD, CONN., U. S. A.
New York: 123 Liberty St. Boston: 144 Pearl St.
Chicago: 42 South Clinton St.
London, Eng.: Buck & Hickman, 280 Whitechapel Road.
Paris, France, Fenwick Freres & Co., 21 Rue Martel.

ENGINE and SPEED LATHES

IN VARIOUS LENGTHS—9 to 15 in. SWING.
Latest and Most Approved Designs. Workmanship, Material and Finish of the Highest Order.

SEBASTIAN LATHE COMPANY,
117 and 119 Culvert Street CINCINNATI, OHIO, U. S. A.
Agents: SELIG, SONNENTHAL & CO., London, Eng.; JOHN TAGARDH & CO., Göteborg, Sweden; E. SONNENTHAL, JR., Berlin, Germany; R. S. STOKVIS & ZONEN, Rotterdam, Holland.

JUST ISSUED. NEW EDITION.

A Catalogue of Text-Books and Industrial Works.

JOHN WILEY & SONS, 53 E. Tenth Street, New York.
This Catalogue will be sent free by mail to anyone ordering it.

FINE MACHINE RELIEVED TAPS.
"Lightning" and "Green River" Screw Plates, Dies, Tap Wrenches, Bolt Cutters and Drilling Machines for Hand and Power, Punching Presses, etc. SEND FOR CATALOGUE.

WILEY & RUSSELL MFG. CO., Greenfield, Mass., U. S. A.
Agents in London SELIG, SONNENTHAL & CO., 85 Queen Victoria Street.

WE CLAIM THE FOLLOWING MERITS FOR **JENKINS BROS.' VALVES.**

1. Manufactured of the best Steam Metal.
2. No regrinding: therefore not constantly wearing out the Seat of the Valves.
3. Contain JENKINS DISC, which is suitable for all Pressures of Steam, Oil and Acids.
4. The Easiest Repaired, and all parts Interchangeable.
5. Every Valve Tested before leaving the factory.
6. ALL GENUINE stamped with Trade Mark.

JENKINS BROTHERS, New York, Philadelphia, Chicago, Boston.

HUGH HILL CUT-OFF TOOL.

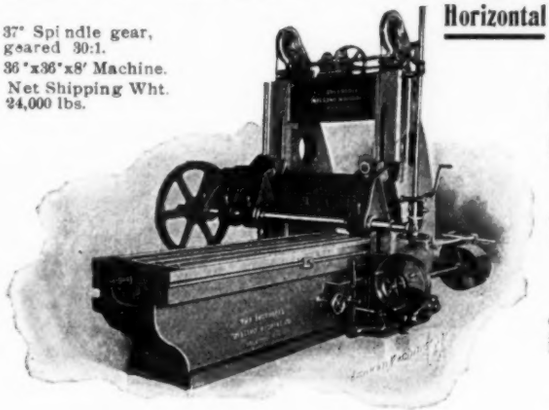
Made in all sizes and using self-hardening steel blades. HUGH HILL TOOL CO., Anderson, Ind.

THE BENTEL & MARGEDANT COMPANY
MANUFACTURERS OF WOODWORKING MACHINERY
HAMILTON, O. U.S.A.

HEAVY MILLING MACHINES EXCLUSIVELY.

Horizontal or Vertical Spindles or Both.

37" Spindle gear, geared 30:1.
36"x36"x8' Machine.
Net Shipping Wht. 24,000 lbs.



SIZES:
15", 20", 24", 30", 48", 60", any length.

Wide range of cutter speeds.
Variable table feed from 3-16" to 10" per minute.
Power elevating and lowering device.
Table adjusted by power in either direction.

Write for full information and prices to

The Ingersoll Milling Machine Co.
P. O. Box 2777,
ROCKFORD, ILL., U. S. A.

FOREIGN AGENTS:
C. W. Burton, Griffiths & Co., London, Eng.
A. Janssens, Paris, France.
DeFries & Co., Berlin and Dusseldorf.

EASTERN BRANCH,
126 Liberty Street, New York.
Cable Address: "Ingersoll," Rockford.

many is an increase in home trade, which, after all, is the great desideratum.

The building of larger plants is epidemic in Cincinnati. The Bradford Mill Company intends to enlarge its works; G. A. Gray Company is building now; R. K. Le Blond is building a separate establishment; Dietz, Schumacher & Boye are moving to their new quarters; as mentioned in our electrical report, the Bullock Electric Company is building new works, and doubtless others also are adding to their plants.

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Quotations.

NEW YORK, Monday, March 7.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$11 00	@	11 50
No. 2 foundry, Northern	10 50	@	10 75
No. 2 plain, Northern	10 00	@	10 50
Gray forge, Northern	10 00	@	10 50
No. 1 foundry, Southern	10 75	@	11 00
No. 2 foundry, Southern	10 25	@	10 50
No. 3 foundry, Southern	10 00	@	10 25
No. 1 soft, Southern	10 75	@	11 00
No. 2 soft, Southern	10 25	@	10 50
Foundry forge, Southern	9 75	@	10 00

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.07½ @ 1.10c.; refined 1.15 @ 1.20c. Store prices: Common, 1.25 @ 1.35c.; refined, 1.30 @ 1.50c.

Tool Steel—Ordinary sizes, standard quality, 6 @ 7c., with some grades perhaps a little less; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—Ordinary brands, from store, in small lots, 1.45 @ 1.60c.

Cold Rolled Steel Shafting—Base sizes, from store, in retail lots, 2.20 @ 2.25c.

Copper—Carload lots: Lake Superior Ingot, 12c.; electrolytic, 11¾c.; casting copper, 11⅝c.

Pig Lead—Carload lots, 3.80 @ 3.85c., f. o. b. New York.

Pig Tin—For 5 and 10 ton lots, 14.35 @ 13.40c., f. o. b.

Spelter—Carload lots 4.15 @ 4.25c., New York delivery.

Antimony—Cookson's, 8c.; Hallett's, 7¾c.

Lard Oil—Prime City, present make, 44 @ 46c., in wholesale lots.

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Manufacturers.

Waterbury, Vt., is to install an electric light plant.

The Enterprise Foundry Company, Bellaire, Ill., is about to enlarge its plant.

A new glass factory is to be erected by the Toledo (Ohio) Glass Company.

The Henrietta Window Glass Company is to erect at Baltimore, Md., a new factory.

At Philadelphia, Pa., Henry Tetlow is to erect a new four story soap and perfume factory.

The Kemp Manufacturing Company, of Toronto, Ont., is to erect an addition to its factory.

The Marsden Cellulose Company, of Philadelphia, Pa., is about to establish a plant at Springfield, Ohio.

The Aurora (Ill.) Boiler Works has been incorporated by J. W. Battle, John W. Kelley and R. B. Scott.

The Pittsfield (Mass.) Electric Company has decided to erect a new building and place in it new machinery.

The Utah Sugar Company, of Ogden, Utah, contemplates the erection of a new factory at La Grande, Ore.

The plant of the Kensington Hygeia Ice Company at Philadelphia, Pa., is to undergo considerable improvement.

Stearns & Castor, architects, have begun the preparation of plans for a five story factory at Philadelphia, Pa.

Estimates are being taken at Ephrata Pa., for a silk mill to be built there by a party of manufacturers from Paterson, N. J. Messrs. Westerhoff Bros., of Paterson, are at the head of the project, and the plans prepared call for a brick and iron building, four stories and basement, measuring about 100x50 feet. It will be

furnished with the latest machinery, boilers, engines and pumps.

The W. A. Case estate is to build a power station on Washington street, Lincoln, Neb.

Gaunt Bros. are making room for additional machinery in the basement of their mill on Osgood street, Methuen, Mass.

The American Manufacturing Company, of Greenpoint, Long Island, N. Y., is making considerable addition tto its plant.

The Wiscassett Cotton Milling Company, of Albemarle, Del., has been organized. J. W. Cannon was elected president.

It is expected that the Mitchell-Tantes Rolling Mill Company, of Covington, Ind., will remove to Anderson in the same State.

The flavine mills of the John T. Young Company at Hanover, Pa., were recently destroyed by fire. All the stock and machinery were lost.

The Island Foundry Company and Grant-Ferris Company, Green Island, N. Y., owned by D. Powers & Son, will soon enlarge their plant.

E. M. Van Dwyer, of No. 98 Thomas street, has drawn plans for the brick addition to the varnish factory of Flood & Conklin, Chestnut street, Newark, N. J.

Philip Haibach has filed plans for a three story brick factory, 54x59 feet, at Nos. 1256 to 1260 North Stillman street, Philadelphia, Pa., for C. W. Young & Co.

The copartnership heretofore known as the Niagara Stamping & Tool Company, Buffalo, N. Y., has changed its firm title to the Niagara Machine & Tool Works.

George F. Lum proposes to go ahead with the construction of his power house at Clark's Mills, N. Y. Electricity will be furnished to Albion for both light and power.

The Huntsville Brick Company was recently organized at Huntsville, Ala. A new plant will be secured and modern machinery installed. Robt. Dyas, J. I. Jones and W. L. Jones are the incorporators.

The Sager Gear Company, of Rochester, N. Y., has been incorporated to manufacture machines and tools. The directors are Erickson Perkins, D. H. Sager, Geo. C. Sager, F. W. Zoller and F. P. Allen.

The Lafayette Brick Works, a new concern, manufacturing bricks of all kinds, and backed by capitalists from Lafayette and Chicago, has been located at Anderson, Ind. The company will at once erect buildings.

The Nineteen Hundred Washer Company, of Binghamton, N. Y., has been incorporated to manufacture washing machines and wringers. Thos. B. Crary, M. A. Miller and R. F. Bieher, of Binghamton, are the directors.

The Hess Manufacturing Company recently elected the following as directors: John G. Hess, John W. Koogle, U. M. Hess, M. E. Hess and W. H. Albaugh. The company proposes to sell the present factory and purchase a new site where more room can be secured.

Contractor Robert Beatty, Frankford, Pa., is receiving estimates on the yarn mill and dye house to be erected at Tacony, Pa., for Messrs. W. & R. Ford. It will be brick and iron, two stories and basement, measuring 50x50 feet.

Frank L. Smith, Pittsfield, Mass., has sold his steam sawmill plant to a new firm, consisting of Augustus H. Conant, of Boston, and Frank L. Smith and R. A. Conant, of Pittsfield, the firm to be known as Smith & Conant Bros. In addition to the plant as it now is the owners will erect an addition for the manufacture of spools, and will introduce new features in wood working, all to be equipped with modern machinery.

The German-American Steel Ball Company, to manufacture ball bearings, etc., of Camden, N. J., has been incorporated; capital, $200,000. Corporators, S. D. Lehr, H. K. Hartzell, A. S. Wilson, H. G. Schelden, Willoughby S. Mayer, Edgar C. Shimer, J. D. Christman, E. J. Lichtenwahner, C. F. Wolferts, E. Celler, Frederick E. Lewis, B. T. Keyser and H. G. Smith, of Allentown, Pa.; Josef Kuyler Prutze, Schweinfurt, Germany; Leonhardt Seling, Pittston, Pa., and James Westland, of Philadelphia.

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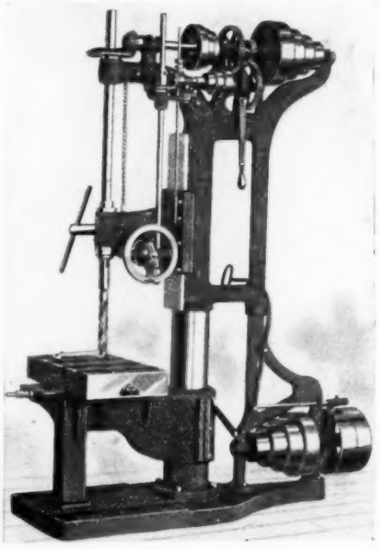

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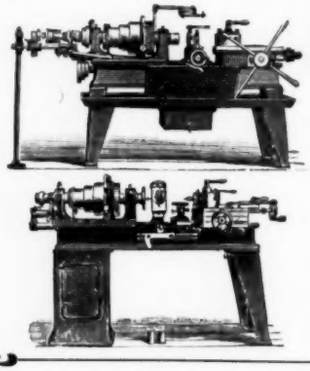

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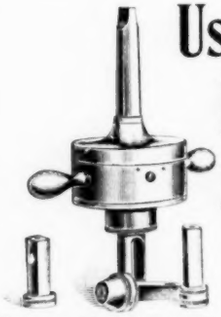

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Lathes, 15 inch, 18 inch, 22 inch and 32 inch swing.

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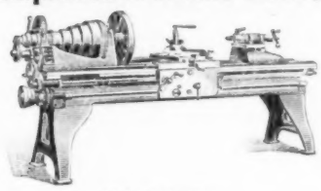
Elliptical Gear Crank Shapers, 14 inch, 18 inch and 22 inch.



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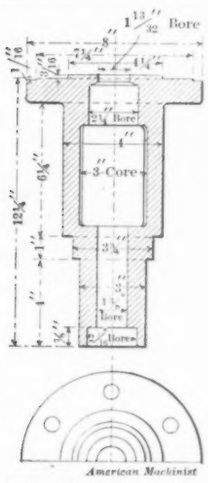

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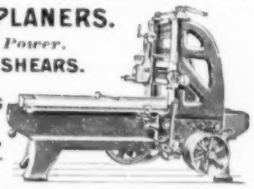

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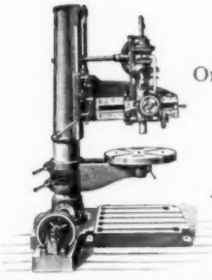

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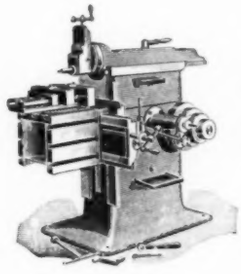

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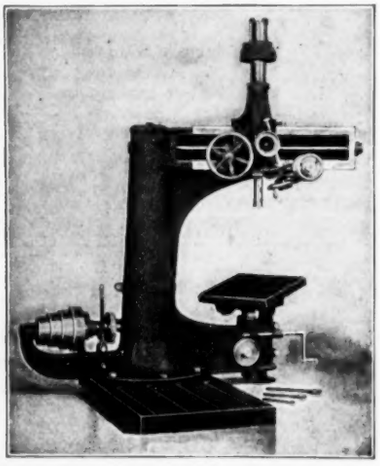

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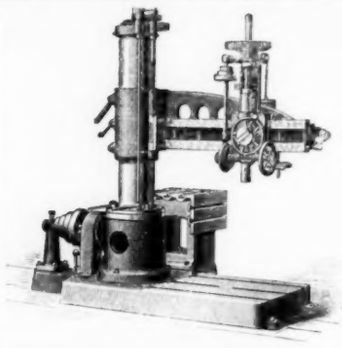

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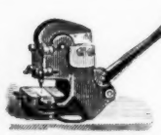

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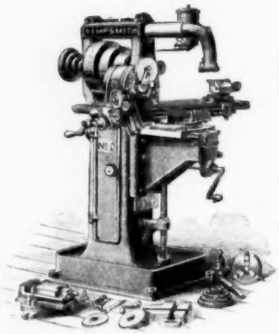

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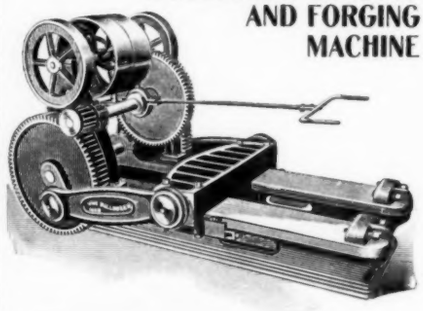

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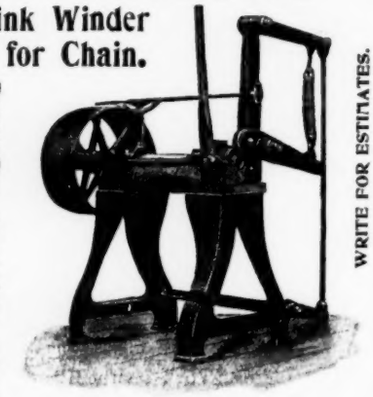

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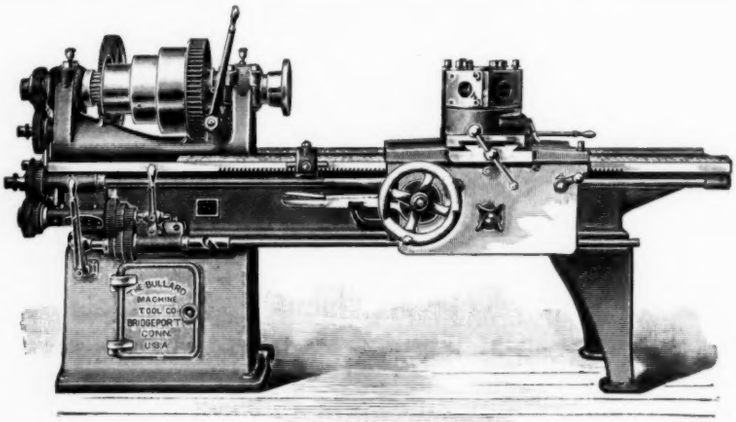

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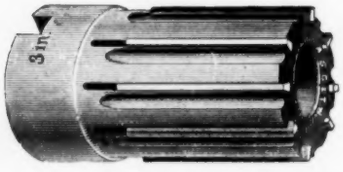

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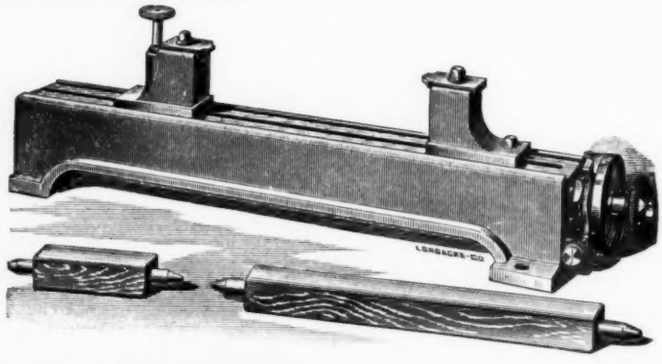

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33 IN. SWING Ditto. (Fine shape.)
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51 IN. SWING BULLARD VERTICAL BORING MILL, with 2 heads. Very latest pattern and good as new.
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48 IN. x 48 IN. x 12 FT. POWELL PLANER, 2 heads and power lift to cross rail. Latest pattern and fine shape.
26 IN. x 26 IN. x 10 FT. POWELL PLANER, 2 heads. Latest pattern. Fine order
NEWTON PLAIN MILLING MACH., with back gears and all usual attchts. A1.
NEWTON PLAIN MILLING MACH., same attchts.
18 IN. STROKE PUTNAM LATEST IMPROVED SLOTTING MACHINE, all feeds. Very heavy and powerful. Good as new.
20 IN. BARNES DRILL, with automatic feed.
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NO. 21 BLISS INCLINED POWER PRESS, with bolster, and lot die beds. A1.
NO. 11 BROWN POWER PRESS, extra heavy, with bolster and lot die beds. A1.
NO. 31 BLISS DOUBLE CRANK POWER PRESS, 46 in. between housings, with lot attchts. A1.
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22 IN. x 18 FT. POND LATHE, C. Rest and P. C. Feed; has chuck.
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TWO 16 IN. x 8 FT. J. L. BOGERT LATHE, El. Rest, weight carriage.
TWO 14 IN. 6 FT. J. L. BOGERT LATHE, El. Rest, weight carriage.
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5 FT. BEMENT BORING AND TURNING MILL, 1 head.
72 IN. NILES PULLEY LATHE, 2 tools.
42 IN. x 42 IN. x 16 FT. BEMENT PLANER, 1 head.
36 IN. x 36 IN. x 16 FT. POND PLANER, 1 head.
30 IN. x 30 IN. x 8 FT. N. Y. STEAM ENG. PLANER, 1 hd.
24 IN. x 24 IN. x 5 FT. GRAY, Latest Pat. PLANER, 1 hd.
500 lb. BEMENT-MILES STEAM HAMMER, 20 in. stroke.
2 IN. SELLARS AUT. BOLT CUTTER, 4 die, aut. pump.
1 1-4 IN. ADAMS AUT. BOLT CUTTER, 4 die, aut. pump.
6 IN. BEMENT SLOTTER, all feeds.
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36 IN. SWING N. Y. STEAM ENG. CO. UPRIGHT DRILL, B'gs and P. Feed.
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32 IN. SWING PRATT & WHITNEY UPRIGHT DRILL. B'gs. and P. Feed.
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No. 1 BROWN & SHARPE UNIVERSAL MILLER, all parts.
No. 2 BROWN & SHARPE PLAIN MILLER.
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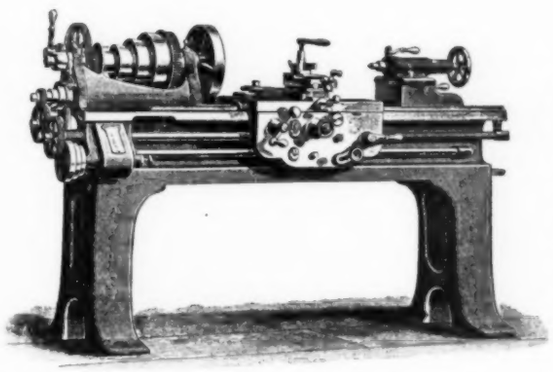

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LARGE SIZES.

1 60 in. x 22 ft.	All Triple Geared
1 50 in. x 12 ft.	
1 42 in. x 22 ft.	
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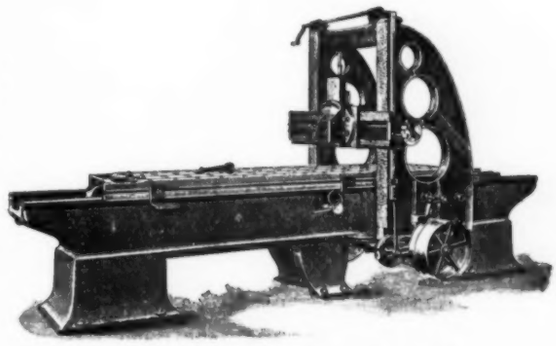
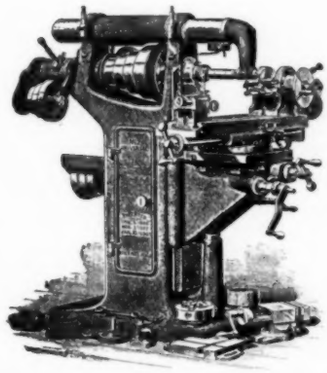
1 36 in. x 16 ft.	All Standard Lathes with Regular Attachments.
1 30 in. x 15 ft.	
1 30 in. x 17 ft.	
2 28 in. x 12 ft.	
1 28 in. x 14 ft.	
5 24 in. x 12 ft.	
1 24 in. x 16 ft.	
1 24 in. x 10 ft.	
2 21 in. x 10 ft.	
3 18 in. x 8 ft.	

PLANERS IN STOCK.

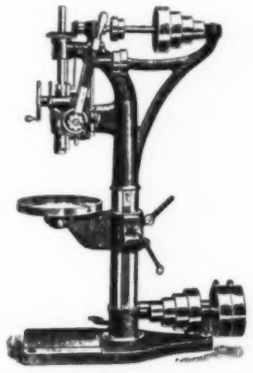
48 x 48 in. x 12 ft., 2 heads
38 x 38 in. x 10 ft., 2 heads
36 x 36 in. x 10 ft., 1 head
30 x 30 in. x 8 ft., 1 head
28 x 28 in. x 8 ft., 1 head
24 x 24 in. x 6 ft., 1 head
22 x 22 in. x 5 ft., 1 head
20 x 20 in. x 4 ft., 1 head
18 x 18 in. x 4 ft., 1 head
16 x 16 in. x 3 ft., 1 head



30 x 30 in. x 8 ft. L. W. POND PLANER.



No. 2 CINCINNATI UNIVERSAL MILLER.



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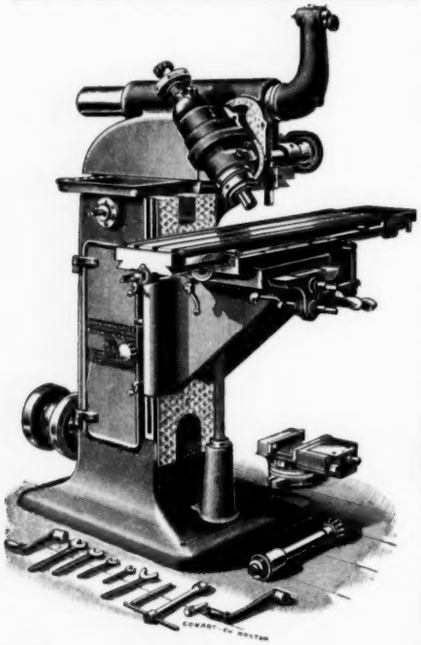

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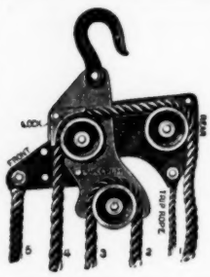

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Lathes, 15 inch, 18 inch, 22 inch and 32 inch swing.

Geared Shapers, 22 inch, 26 inch, 30 inch, 34 inch and 48 inch stroke.

Elliptical Gear Crank Shapers, 14 inch, 18 inch and 22 inch.

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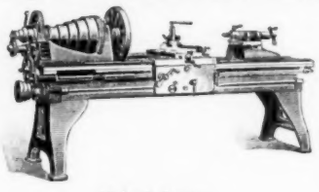

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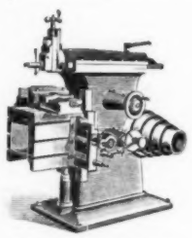

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12 in. x 5 ft., Prentiss, raise and fall rest.
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14 in. x 6 ft., Putnam, latest cpd. rest, cross feed.
16 in. x 6 ft., Fitchburg, cpd. rest and taper att.
16 in. x 6 ft., Putnam, P. F. rest, cross feed.
16 in. x 7 ft., Pratt & Whitney, raise and fall rest.
16 in. x 12 ft., Bridgeport, heavy pattern, cross feed.
18 in. x 8 ft., Flather, latest cpd. rest, cross feed.
20 in. x 8 1-2 ft., New Haven, latest pattern, cpd. rest, cross feed.
22 in. x 10 ft., Pond, cpd. rest, cross feed and chuck.
23 in. x 12 ft., New Haven, cpd. rest and cross feed.
24 in. x 8 ft., Fifield, cpd. rest and cross feed.
26 in. x 9 ft., Bogert, triple geared, cpd. rest, cross fd.
26 in. x 10 ft., Fifield, cpd. rest and cross feed.
26 in. x 12 ft., Putnam, cpd. rest and cross feed.
32 in. x 14 ft., Fitchburg, cpd. rest and cross feed.
32 in. x 18 ft., Fay & Scott, cpd. rest and cross feed.
40 in. x 20 ft., Pond, extra heavy cpd. rest, cross feed.
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24 in. wide 6 ft. long, Lodge, Davis & Co.
26 in. wide 6 ft. long, Pond Mch. Tool Co.
26 in. wide 8 ft. long, Fitchburg Machine Co.
30 in. wide 8 ft. long, Gray Co's. latest pattern.
30 in. wide 9 ft. long, Rochester Machine Tool Works.
32 in. wide 8 ft. long, D. W. Pond, two heads.
36 in. wide 8 ft. long, Bement.
36 in. wide 14 ft. long, Betts Machine Co.'s.
42 in. wide 14 ft. long, Powell, late pattern four heads.
48 in. wide 16 ft. long, Pond Mach. Tool Co., four hds.

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14 in. stroke Friction, Prentiss.
16 in. stroke Crank, Gould & Eberhardt, late pattern.
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24 in. stroke Friction, Hendey Machine Co.
14 in. stroke, 28 in. feed, trav. head, Fitchburg.

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9-16 in. Jones & Lamson, wire feed, chuck, etc.
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1 1-32 in. Bardons & Oliver, wire feed, chuck, etc.
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1 1-2 in. Jones & Lamson, friction gears, turret feed and chuck.
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Sensitive, Hurlburt & Rogers, with chuck.
20 in., Prentiss, wheel and lever feeds.
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26 in., Lodge-Davis, back-geared, sliding head, hand fd.
28 in., Barnes, back-geared, auto. feed, complete.
30 in., Prentiss, back-geared, auto. feed, complete.
32 in., Prentiss, back-geared, auto. feed, complete.

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62 in. swing, Dreses-Mueller, with all attachments.
110 in. swing, Baush, latest pattern, complete,
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32 in. Whiton, cuts spur, bevel and worm.
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1 15 in. x 6 ft. Star.
1 15 in. x 6 ft. Wood & Light.
1 16 in. x 5 ft. Ames.
1 16 in. x 7 ft. Dustin & Hubbard.
1 18 in. x 8 ft. Dustin & Hubbard.
1 21 in. x 9 ft. Pratt & Whitney.
1 24 in x 13 ft. Lathe & Morse.
1 27 in. x 10 ft. Dustin & Hub.
1 28 in. x 12 ft. Wood & Light.
1 32 in. x 13 ft. Bement.
1 48 in. x 18 ft. G. & S.
1 Pit Lathe, 72 in. x 18 ft.

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1 24 x 24 in. x 6 ft. Powell.
1 24 x 24 in. x 7 ft. Lathe & Morse.
1 28 x 28 in. x 8 ft. G. & S.
1 30 x 30 in. x 10 ft. Niles.
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1 36 x 36 in. x 18 ft., Wm. Sellers.
1 48 x 32 in. x 6 ft. Pond, 2 hds.

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1 13 in. Traveling Head, Bement.
1 15 in. Crank Motion, Springfield.
1 15 in. Crank Motion, Kelly.

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2 No. 1 Garvin Universals.
1 No. 1 Cincinnati Universal.
1 No. 15 Garvin, back geared.
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1 22 in. Prentice Bk. G. & P. F.
1 3-Spindle Hendey.
1 No. 3 4-Spindle Garvin.
1 6-Spindle Quint.
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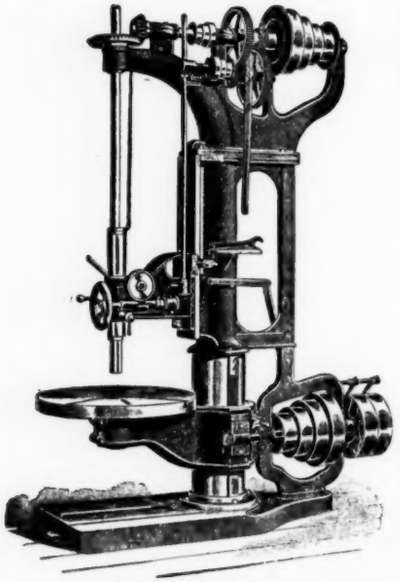

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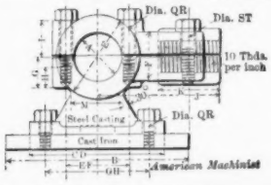

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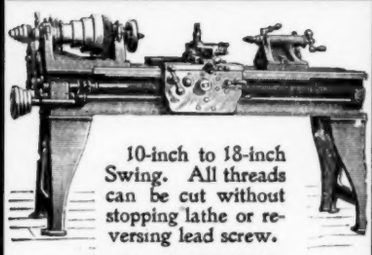

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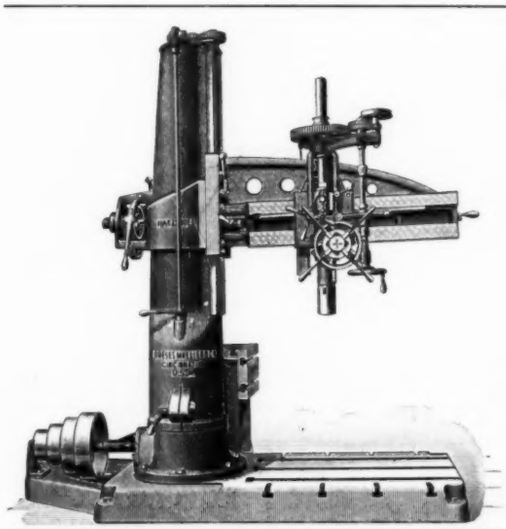

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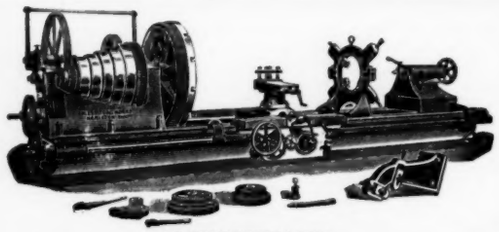

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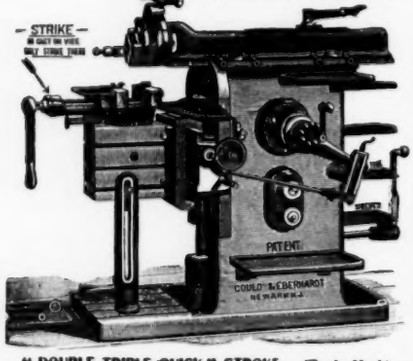

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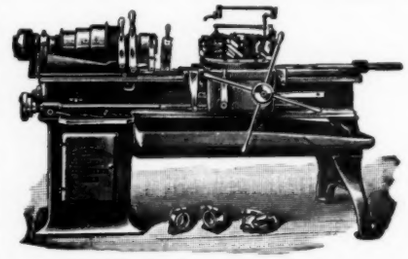

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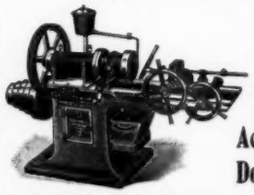

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